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SELECTED WATER RESOURCES ABSTRACTS

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VOLUME 11, NUMBER 6
MARCH 15, 1978

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 11, NUMBER 6
MARCH 15, 1978

W78-02201 -- W78-02700

The Secretary of the U.S. Department of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION
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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

COMPRESSIBILITY OF DISTILLED WATER AND SEAWATER,
Woods Hole Oceanographic Institution, MA.
For primary bibliographic entry see Field 2K.
W78-02613

2. WATER CYCLE

2A. General

A COMPARISON BETWEEN CONVENTIONAL AND LANDSAT-BASED HYDROLOGIC MODELING: THE FOUR MILE RUN CASE STUDY,
Maryland Univ., College Park. Dept. of Civil Engineering.
R. M. Ragan, T. J. Jackson, W. N. Fitch, and R. P. Shubinski.
Available from the National Technical Information Service, Springfield, VA 22161 as N77-17551, Price codes: A07 in paper copy, A01 in microfiche. Final Report, October 1976. 127 p, 27 fig, 27 tab, 27 ref, 2 append. NASA NSG 5017.

Descriptors: *Model studies, *Remote sensing, *Planning, *Methodology, *Flood control, Aerial photography, Channeling, Detention reservoirs, Watershed management, Hydrology, Discharge(Water), *LANDSAT sensors, *Spectral signature, Spectroreflectance, Land cover.

Many of the models designed to support the hydrologic studies associated with urban water resources planning require input parameters that are defined in terms of land cover. Estimating the land cover is a difficult and expensive task when drainage areas larger than a few sq km are involved. The purpose of the reported investigation was to compare conventional and LANDSAT-based methods for estimating the land cover based input parameters required by hydrologic planning models. Comparisons were based on a case study of the 50.5 sq km (19.5 sq mi) Four Mile Run Watershed in Virginia. Results of the study indicated that the LANDSAT-based approach is highly cost-effective for planning model studies. The conventional approach to define inputs was based on 1:3600 aerial photos, required 110 man-days, and had a total cost of $14,000. The LANDSAT-based approach required 6.9 man-days and cost $2,350. The conventional and LANDSAT-based models gave similar results relative to discharges and estimated annual damages expected from no flood control, channelization, and detention storage alternatives. (Singh-ISWS)
W78-02232

URBAN STORM RUNOFF INLET HYDROGRAPH STUDY: VOL. 4, SYNTHETIC STORMS FOR DESIGN OF URBAN HIGHWAY DRAINAGE FACILITIES,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 4D.
W78-02243

ESTIMATION OF AQUIFER DIFFUSIVITY IN STREAM-AQUIFER SYSTEMS,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soil and Water Engineering.
For primary bibliographic entry see Field 2F.
W78-02250

WISCONSIN, A SUMMARY OF ACTIVITIES AND PLANS OF THE UNITED STATES DEPARTMENT OF THE INTERIOR, GEOLOGICAL SURVEY, 1977,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02415

THE SOIL MOISTURE COMPONENT OF MATHEMATICAL CATCHMENT SIMULATION MODELS,
Seven-Trent Water Authority, Birmingham (England).
For primary bibliographic entry see Field 2G.
W78-02598

2B. Precipitation

DEVELOPMENT OF AN EXPERIMENTAL HYDROMETEOROLOGICAL DATA COLLECTION NETWORK,
Western Scientific Services, Inc., Fort Collins, CO.
J. H. Wagner.
Final Report No. FR-807-55, April 30, 1977. 183 p, 28 fig, 4 append. Submitted to Bureau of Reclamation, Denver, Colo., Div of Atmospheric Water Resources Mgmt. Bur Reclam 14-06-D-7551.

Descriptors: *Data collections, *Precipitation(Atmospheric), Microprocessor, Satellite data collection, Aircraft data collection, *Telemetry, Remote data collection, Digital sensors, Digital data systems, Digital data transmission, Digital data recording, Automatic data collection, LANDSAT data systems, Digital cassette data recording, *Remote sensing, *Networks, Equipment, Instrumentation.

Development is described of an automatic microprocessor based data collection system utilizing VHF telemetry links capable of collecting hydrometeorological data from remote sites distributed over a wide area or in relatively inaccessible terrain. Results of an extensive test program are included along with recommendations for improving the reliability and performance of the system. Detailed schematics for all equipment developed are provided and the operation of each piece of equipment is described. (Bur Reclam)
W78-02228

TRACER AND DIFFUSION AND CLOUD MICROPHYSICAL STUDIES IN THE AMERICAN RIVER BASIN,
Washington Univ., Seattle. Dept. of Atmospheric Sciences.
For primary bibliographic entry see Field 3B.
W78-02229

WORKSHOP REPORT ON ACID PRECIPITATION AND THE FOREST ECOSYSTEM,
Northeastern Forest Experiment Station, Delaware, OH.
For primary bibliographic entry see Field 5A.
W78-02236

URBAN STORM RUNOFF INLET HYDROGRAPH STUDY: VOL. 3, HYDROLOGIC DATA FOR TWO URBAN HIGHWAY WATERSHEDS IN THE SALT LAKE CITY AREA, UTAH,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 4D.
W78-02242

URBAN STORM RUNOFF INLET HYDROGRAPH STUDY: VOL. 4, SYNTHETIC STORMS FOR DESIGN OF URBAN HIGHWAY DRAINAGE FACILITIES,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 4D.
W78-02243

FLUCTUATIONS OF WET AND DRY YEARS, AN ANALYSIS BY VARIANCE SPECTRUM,
Colorado State Univ., Fort Collins.
V. Yevjevich.
Colorado State University Hydrology Paper No. 94, August 1977. 33 p, 10 fig, 6 tab, 10 ref. NSF ENG 74-17396.

Descriptors: *Precipitation(Atmospheric), *Runoff, *Statistical methods, *Effective precipitation, *Regression analysis, Hydrology, Data processing, Analysis, Equations, Computers, Model studies, *Spectral analysis, Stationary series, Independent series.

The spectral analysis was applied to annual series of precipitation and runoff. The precipitation series were divided into homogeneous and non-homogeneous categories. Runoff series are either the observed runoff series or effective precipitation series obtained as difference between precipitation and evaporation. Data from a large number of precipitation and discharge gaging stations from all over the United States were used in the study and were divided into 6 areas. The techniques of spectral analysis were described in a condensed form. Average spectra were estimated for each of the series types in each of the six areas with the proper tolerance limits drawn around the expected values of average spectral densities of independent series. The analyses indicated that annual precipitation series are very close to independent time series. They are stationary series, at least in terms of 100 to 150 years. Annual runoff and effective precipitation are dependent series, with the average first serial correlation coefficient in the range of 0.1 to 0.2. The first- and second-order autoregressive models of series dependence seem sufficiently accurate for use in practical problems. (Singh-ISWS)
W78-02263

ATMOSPHERIC SIMULATION USING STRATIFIED LIQUID MODELS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 3B.
W78-02267

SUMMARY REPORT, GENERALIZED CRITERIA FOR SEEDING WINTER OROGRAPHIC CLOUDS.
Bureau of Reclamation, Denver, CO. Div. of Atmospheric Water Resources Management.
For primary bibliographic entry see Field 3B.
W78-02407

GENERALIZED CRITERIA FOR SEEDING WINTER OROGRAPHIC CLOUDS,
Bureau of Reclamation, Denver, CO. Div. of Atmospheric Water Resources Management.
For primary bibliographic entry see Field 3B.
W78-02408

SEASONAL PATTERNS IN ACIDITY OF PRECIPITATION AND THEIR IMPLICATIONS FOR FOREST STREAM ECOSYSTEMS,
Forest Service (USDA), Durham, NH. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 5C.
W78-02455

SUMMER SOLAR RADIATION AND TEMPERATURE IN RELATION TO MONSOON RAINFALL,
Meteorological Office, Poona (India).
G. Ramachandran, and R. R. Kelkar.

Indian Journal of Meteorology, Hydrology and Geophysics, Vol 28, No 1, p 81-84, January 1977. 4 fig, 2 tab, 2 ref.

Descriptors: *Rainfall, *Air temperature, *monsoons, *Correlation analysis, Regression analysis, Temperature, Precipitation(Atmospheric), Variability, Solar radiation, Forecasting, Model studies, Meteorology, *India.

An examination of observational records of global and diffuse solar radiation during summer from 1964 to 1972 at all stations was made. The results indicated that year-to-year variations of the mean daily radiation received at the surface is small. Further, these variations are not linked to the variations of sub-divisional rainfall during the subsequent monsoon season. Similar results were obtained from an analysis of sub-divisional mean summer temperatures and monsoon rainfall over the period 1936 to 1965. (Sims-ISWS)
W78-02602

FINAL REPORT-NATIONAL HAIL RESEARCH EXPERIMENT RANDOMIZED SEEDING EXPERIMENT 1972-1974, VOLUME I, EXPERIMENTAL RESULTS AND OVERALL SUMMARY,
National Center for Atmospheric Research, Boulder, CO.
For primary bibliographic entry see Field 3B.
W78-02603

FINAL REPORT-NATIONAL HAIL RESEARCH EXPERIMENT, RANDOMIZED SEEDING EXPERIMENT 1972-1974, VOLUME II, PRECIPITATION MEASUREMENTS,
National Center for Atmospheric Research, Boulder, CO.
For primary bibliographic entry see Field 3B.
W78-02604

FINAL REPORT-NATIONAL HAIL RESEARCH EXPERIMENT, RANDOMIZED SEEDING EXPERIMENT 1972-1974, VOLUME III, METEOROLOGICAL SUMMARY,
National Center for Atmospheric Research, Boulder, CO.
For primary bibliographic entry see Field 3B.
W78-02605

FINAL REPORT-NATIONAL HAIL RESEARCH EXPERIMENT, RANDOMIZED SEEDING EXPERIMENT 1972-1974, VOLUME IV, RADAR SUMMARY,
National Center for Atmospheric Research, Boulder, CO.
For primary bibliographic entry see Field 3B.
W78-02606

FINAL REPORT-NATIONAL HAIL RESEARCH EXPERIMENT, RANDOMIZED SEEDING EXPERIMENT 1972-1974, VOLUME V, HAIL DECLARATION PROCEDURES AND SEEDING OPERATIONS,
National Center for Atmospheric Research, Boulder, CO.
For primary bibliographic entry see Field 3B.
W78-02607

THE PAST, PRESENT, AND FUTURE OF THE BIOSPHERE,
M. D. Azevedo.
Actual Biol. 44, p 128-173, 1972.

Descriptors: Arid, *Biosphere, Carbon-14, Energy, Inhibition, Land management, Nitrobacter, Nitrosomonas, Nuclides, Pesticides, Photosynthesis, Pollution, Pseudomonas-denitrificans, Radio, Reproduction, Temperature, Water pollution, Air pollution.

The balance of energy consumed in respiration and energy fixed in production of organic matter is of concern. Water is a main ecological importance in minimizing temperature variations, as well as a support for aquatic life and a component of metabolic phenomena. The effect of cultivation of arid lands has not been well studied. Photosyntheses and biological photolysis of water are the main source of O2 in the atmosphere. Ozone impedes passage of UV radiation. O2 is also released by microorganisms metabolizing nitrates and sulfates. The evolution of the biosphere from a primordial reducing atmosphere is discussed. The equilibrium of CO2 liberated during respiration and CO2 consumed during photosynthesis is vital to the C cycle. Concentrations of 14C in the air and dissolved in sea water has been of great interest in recent years. One of the main interventions man has made in biospheric cycles is fixation of N, which constituted 79% of the biosphere. The equilibrium between fixation by synthetic fertilizers and liberation of N2 from organic compost by microorganisms is vital. N fixation requires vast amounts of energy. Microorganisms such as Nitrosomonas, Nitrobacter, and Pseudomonas dentrificans are involved in transformation. Pollution of the atmosphere with combustion products, radionuclides and pesticides, and disruption of the O2 and CO2 equilibria require remidies and controls. The mutagenic effects of radiation and inhibition of reproduction by many pesticides are of particular concern. Curbs on technology and constructions of nuclear energy centers, in particular, are urged in order to restore the equilibria of the biosphere for the future.--Copyright 1974, Biological Abstracts, Inc.
W78-02654

2C. Snow, Ice, and Frost

DESIGN CONSIDERATIONS FOR SAMPLING PROGRAMS IN REMOTE AREAS,
Alaska Univ. College.
For primary bibliographic entry see Field 7A.
W78-02235

THERMAL REGIME OF AN EARTH DAM BUILT ON A PERMAFROST BASE DURING CONSTRUCTION AND INITIAL OPERATION,
Gorkovskii Inzhenerno-Stroitelnyi Inst. (USSR).
For primary bibliographic entry see Field 8D.
W78-02237

GEOCHEMICAL INVESTIGATIONS OF ICE SHEETS IN MIZUHO PLATEAU AND WEST ENDERBY LAND,
Muroran Inst. of Technology, Hokkaido (Japan).
M. Muromizu.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A030 311, Price codes: A02 in paper copy, A01 in microfiche. Cold Regions Research and Engineering Laboratory Draft Translation 543, September 1976. 21 p, 2 fig, 24 tab. Translated from Japan Antarctic Record, Vol 54, p 49-67, December 1975.

Descriptors: *Antarctic, *Ice, *Chemical analysis, *Sampling, Cold regions, Snow, Snowpacks, Chemicals, Dusts, Sodium, Potassium, Magnesium, Calcium, Silicates, Analytical techniques, Chemistry, Ice sheets, Condensation nuclei.

Chemical features and profiles of ice sheets in Mizuho Plateau and West Enderby Land (Antarctica) were revealed by means of newly developed analytical techniques such as atomic absorption spectrophotometry and isotope dilution mass-spectrometry. The chemical concentration is at the level of only ppb, even for the major components, Na, K, Ca and Mg, chemical properties being homogeneous in the surface sheet but of much vertical complexity. Silicate dusts which functioned as the condensation nuclei for the formation of snow flakes are poor, while sea salts account for more than 90% of the total weight of components. Annual accumulation of chemical components, micrograms/sq cm, is 0.1 for silicate dusts and 0.40, 0.03, 0.1 and 0.06 for Na, K, Mg and Ca originating in the latter source. (Sims-ISWS)
W78-02239

ICE RIDGE FORMATION: PROBABLE CONTROL BY NEARSHORE BARS,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
E. Seibel, C. T. Carlson, and J. W. Maresca, Jr.
Journal of Great Lakes Research, Vol 2, No 2, p 384-392, December 1976. 4 fig, 2 tab, 13 ref.

Descriptors: *Ice, *Shores, *Great Lakes, *Lake Michigan, On-site investigations, Photography, Ice lakes, Lakes, Ice breakup, Erosion, Sediments, Data processing, Geomorphology, Limnology, *Ice ridges, Offshore bars, Breaker zones.

During the 1973-1974 winter season, a time-lapse photographic system was used to provide a nearly continuous record of ice conditions along a segment of the southeastern Lake Michigan shoreline. By analysis of the photographs, a typical sequence of nearshore ice formation through break-up was identified. From the record of nearshore ice formation, a three-element mechanism for the development of the near-shore ice ridges in the vicinity of the study site was formulated. A quantitative analysis of the photographs was used to test and subsequently to verify the hypothesis that the nearshore ice ridges, offshore bars, and breaker zones are coincident in location at approximately 40, 105, and 205 meters from the water's edge. Observations revealed that large quantities of sediment are incorporated into the nearshore ice, and that the nearshore ice ridges are grounded on the nearshore bottom in the proximity of the offshore bars. It is believed that the grounded nearshore ice ridges simultaneously modify the nearshore topography and protect the shoreline and bluffline from erosion by winter storms. The degree to which the nearshore is protected or modified has not yet been established. (Sims-ISWS)
W78-02254

SUMMARY REPORT, GENERALIZED CRITERIA FOR SEEDING WINTER OROGRAPHIC CLOUDS.
Bureau of Reclamation, Denver, CO. Div. of Atmospheric Water Resources Management.
For primary bibliographic entry see Field 3B.
W78-02407

GENERALIZED CRITERIA FOR SEEDING WINTER OROGRAPHIC CLOUDS,
Bureau of Reclamation, Denver, CO. Div. of Atmospheric Water Resources Management.
For primary bibliographic entry see Field 3B.
W78-02408

RECONNAISSANCE HYDROLOGY OF PORTAGE GLACIER BASIN, ALASKA--1972,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02414

HYDROLOGIC RECONNAISSANCE OF THE EASTERN NORTH SLOPE, ALASKA, 1975,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 4A.
W78-02424

MICROBIOLOGICAL STUDIES OF THE WANDA LAKE (ANTARCTICA), (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Inst. Mikrobiologii.

For primary bibliographic entry see Field 5C.
W78-02469

NEW TECHNOLOGY OF DRILLING WELLS IN PERMAFROST: CHAPTER 6, DRILLING WITH SIMULTANEOUS FREEZING OF WET, LOOSE ROCKS,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 8B.
W78-02544

GEOMETRY AND DYNAMICS OF A SURGE-TYPE GLACIER,
Washington Univ., Seattle. Geophysics Program.
R. Bindschadler, W. D. Harrison, C. F. Raymond, and R. Crosson.
Journal of Glaciology, Vol 18, No 79, p 181-194, 1977. 10 fig, 1 tab, 28 ref. NSF GA-36039, GA-36040.

Descriptors: *Glaciers, *Alaska, *Movement, *Ice, Glaciology, Seismic studies, Travel time, Profiles, Stress, Shear stress, On-site investigations, On-site data collections, Temperate, Dimensions, Width, Depth, Size, Measurement, Evaluation, Surveys, Velocity, *Variegated glacier, Surge-type glaciers, Mass balance.

Measurements of geometry, motion, and mass balance from Variegated Glacier, Alaska, portrayed conditions in this surge-type glacier close to the mid-point of its 20 year surge cycle. Comparison of longitudinal profiles of ice depth, surface slope, and surface speed indicated that the motion occurs largely by internal deformation, assuming the ice deforms according to the experimental law of Glen. Surface speed is not noticeably affected by local surface slope on the scale of the ice thickness or smaller, but speed correlates well with slope determined on a longitudinal averaging scale about one order of magnitude larger than the ice depth. The rate of motion on Variegated Glacier agrees well with rates on non-surge type temperate glaciers which have similar depth and slope. Although the flow regime at the time of the measurements is apparently typical of temperate glaciers, a large discrepancy between the balance flux needed for steady-state and the actual flux is indicative of a rapidly changing surface elevation profile and internal stress distribution. On Variegated Glacier and other surge-type glaciers, the course of thickening and steepening which would eventually lead to a steady-state geometry and flow by normal processes is interrupted by the catastrophic instability which leads to the surge. (Humphreys-ISWS)
W78-02579

MICROWAVE EMISSIVITY AND ACCUMULATION RATE OF POLAR FIRN,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
H. J. Zwally.
Journal of Glaciology, Vol. 18, No. 79, p 195-215, 1977. 9 fig, 5 tab, 17 ref.

Descriptors: *Snow, *Firn, *Mathematical studies, *Microwaves, Theoretical analysis, Mathematical models, Analytical techniques, Crystals, Polar regions, Temperature, Remote sensing, Snowfall, Measurement, Emissivity, Radiative transfer, Accumulation rate.

Radiative transfer theory was formulated in terms of a radiative transfer function. An effective physical temperature was defined and used to define a generagl bulk emissivity. An approximate radiative transfer function, which is valid if the volume scattering is small relative to the absorption, was used to calculate the brightness temperature, effective physical temperature, and emissivity in order to illustrate the effects of various absorption and scattering coefficients and temperature variations. It also was used to calculate emissivities based on snow crystal size measurements for comparison with observed emissivities and to estimate the sensitivity of the emissivity to changes in the snow characteristics. An appropriate quantity for comparing calculations and observations is the mean emissivity. The agreement between the observed emissivities at seven locations and the calculated emissivities using one empirical parameter showed that the crystal size variation with depth is a primary parameter influencing the microwave emission of dry polar firn. The estimated sensitivities of the emissivity are such that, given an independent mean surface temperature to an accuracy of 1 K and a radiometer accuracy of 1 K, the accumulation rate should be measurable to an accuracy of the order of 20% at most locations. The importance of a satellite measurement of accumulation will be in the capability to interpolate or extrapolate spatial patterns relative to locations of accurate surface measurements. (Humphreys-ISWS)
W78-02580

PHASE-SENSITIVE RADIO-ECHO SOUNDING AT THE DEVON ISLAND ICE CAP, CANADA,
Bristol Univ. (England). H. H. Wills Physics Lab.
M. E. R. Walford, P. C. Holdorf, and R. G. Oakberg.
Journal of Glaciology, Vol. 18, No. 79, p 217-229, 1977. 5 fig, 1 tab, 5 ref.

Descriptors: *Sounding, *Glaciology, *Instrumentation, *Canada, Ice, On-site tests, On-site investigations, Radio waves, Surveys, Monitoring, Networks, Theoretical analysis, Measurement, Testing procedures, Exploration, Analytical techniques, *Devon Island(Canada), Radio-echo sounding.

A radio-echo sounder was built with which both the amplitude and phase of radio echoes can be measured. In experiments with the instrument at the Devon Island ice cap in the Canadian Northern Territories, precise amplitude and phase measurements were made upon radio echoes from the bed of the ice cap. If the measurements are repeated after a number of years, the results, considered in conjuction with snow accumulation and compaction data, will be interpretable as a long-term change in the thickness of the ice cap. Wave dislocations and bend points were observed in radio echoes reflected from the bed. It was suggested that amplitude and phase measurements from a network of sites may be synthesized in order to explore the geometry of the reflecting surface on a fine scale. (Humphreys-ISWS)
W78-02581

MIGRATION OF INSOLUBLE AND SOLUBLE IMPURITIES IN TEMPERATE ICE: STUDY OF A VERTICAL ICE PROFILE THROUGH THE GLACIER DU MONT DE LANS (FRENCH ALPS),
Grenoble-1 Univ. (France). Inst. de Geographie Alpine.
M. Ricq-de Bouard.
Journal of Glaciology, Vol 18, No 79, p 231-238, 1977. 4 fig, 3 tab, 8 ref.

Descriptors: *Glaciers, *Mineralogy, *Profiles, *Surveys, Ice, Chemical properties, Temperate, Alpine, Foreign countries, Foreign research, Sampling, Analysis, Sodium, Calcium, Potassium, Magnesium, On-site investigations, On-site data collections, Cations, Leaching, *France, *Glacier du Mont de Lans.

Ice samples representing at least some twenty years' accumulation, were collected from a crevasse wall at 3,200 m (Glacier du Mont de Lans, Massif de l'Oisans), with a view to studying the behavior of soluble and insoluble impurities in temperate ice. The stratification of the ice from the surface to 2 m and the disappearance of this stratification below 2 m were attributed to a variation in the glacier regime on both sides of the equilibrium line, rather than to a variation in the conditions of deposit of solid debris on the glacier surface, the strata do not necessarily correspond to an annual accumulation. Mineralogical analysis of the solid particles showed two kinds of deposit: that consisting of the local Alpine material (hornblende) and that consisting of a mixture of local material and red sand of Saharan origin (anatase). A study of the distribution of major cations (Na, K, Mg, Ca) along a profile revealed the existence of a process of leaching which follows an exponential law to a first approximation. The leaching produces a rapid evolution in the chemical properties of the ice compared with those of the original precipitation. (Humphreys-ISWS)
W78-02582

GLACIOLOGICAL PROBLEMS SET BY THE CONTROL OF DANGEROUS LAKES IN CORDILLERA BLANCA, PERU. I. HISTORICAL FAILURES OF MORAINIC DAMS, THEIR CAUSES AND PREVENTION,
Centre National de la Recherche Scientifique, Grenoble (France). Lab. de Glaciologie.
L. Lliboutry, B. Morales Arnao, A. Pautre, and B. Schneider.
Journal of Glaciology, Vol 18, No 79, p 239-254, 1977. 10 fig, 26 ref.

Descriptors: *Solifluction, *Disasters, *Lakes, *Glaciology, *South America, History, Dam failure, Mudflows, Glaciers, Ice, Glacial drift, Dams, Debris avalanches, Avalanches, Lake morphology, Geomorphology, Movement, Erosion, Data collections, Foreign countries, *Peru, *Cordillera Blanca(Peru), Proglacial lakes, Moraimic dams.

The retreat of glaciers since 1927 in Cordillera Blanca has produced dangerous lakes at the front of many glaciers. All the known data, most of them unpublished, were reviewed. The known aluviones were listed, and those of Chavin, Quebrada Los Cedros, and Artesoncocha described in full. In the three mentioned cases a breach in the front moraine came from big ice falls into the lake. The protective devices made on the outlets were described, as well as the effects of the big earthquake on 31 May 1970. In the case of Laguna Paron, which keeps its level thanks to infiltrations, the fluctuations of the discharge of the springs as related to the level of the lake from 1955 to 1965 were reported. The projects for lowering the level of Laguna Paron and for emptying Safuna Alta were described. The latter partially emptied by piping after the earthquake, allowing a final solution. (See also W78-02584 and W78-02585) (Humphreys-ISWS)
W78-02583

GLACIOLOGICAL PROBLEMS SET BY THE CONTROL OF DANGEROUS LAKES IN CORDILLERA BLANCA, PERU. II. MOVEMENT OF A COVERED GLACIER EMBEDDED WITHIN A ROCK GLACIER,
Centre National de la Recherche Scientifique, Grenoble (France). Lab. de Glaciologie.
L. Lliboutry.
Journal of Glaciology, Vol 18, No 79, p 255-273, 1977. 13 fig, 5 tab, 13 ref.

Descriptors: *Glaciers, *South America, *On-site investigations, *Model studies, Glaciology, Ice, Mathematical models, Creep, Data collections, Movement, Velocity, Glacial drift, Surveys, On-site data collections, Analytical techniques, Springs, Discharge(Water), Melt water, Electrical properties, Resistivity, Exploration, Ablation, Deformation, Physical properties, Lakes, *Peru, *Cordillera Blanca(Peru), *Glaciar Hatunraju.

In front of Laguna Paron there is a huge moraine which turns through 90 deg in the middle of the valley and with a narrow covered glacier on the top. It has been studied by electrical exploration and by using the displacements of 43 marked boul-

ders on the glacier. Assuming a uniform balance on the glacier tongue and semi-elliptical cross sections, it has been possible to estimate the balance and the glacier thickness. A great amount of the measured velocity comes from the creep of the moraine itself, which seems to be a kind of rock glacier, probably without interstitial ice. It must have taken all the Holocene for the moraine to be formed. During its complex history, a proglacial lake must have formed at some time, the rupture of which explains the crooked form. (See also W78-02583 and W78-02585) (Humphreys-ISWS)
W78-02584

GLACIOLOGICAL PROBLEMS SET BY THE CONTROL OF DANGEROUS LAKES IN CORDILLERA BLANCA, PERU. III. STUDY OF MORAINES AND MASS BALANCES AT SAFUNA,
Centre National de la Recherche Scientifique, Grenoble (France). Lab. de Glaciologie.
L. Lliboutry, B. Morales Arnao, and B. Schneider.
Journal of Glaciology, Vol 18, No 79, p 275-290, 1977. 11 fig, 6 tab, 15 ref.

Descriptors: *Glacial drift, *South America, *Glaciers, *Geomorphology, Ice, Exploration, Glaciology, On-site investigations, Surveys, Analytical techniques, Analysis, Ablation, Movement, Velocity, Precipitation(Atmospheric), Climatic data, Climatology, Foreign countries, Air temperature, *Peru, *Cordillera Blanca(Peru), Mass balance.

The authors explained how preliminary results concerning the internal constitution of the big push moraine at Safuna were obtained in 1967. Cross sections which were obtained later through electrical and seismic exploration and arduous borings were given. Under the lake Safuna Alta there exists a layer of dead ice which is probably a remnant from an old glacier advance and over which the active glacier slides, but the dead ice does not extend into the push moraine. Since 1950, Safuna Alta has formed, the glacier tongue has lowered by 0.8 m per year on average, and the big push moraine has moved and settled. The annual balance on the glacier tongue was measured in 1968. It increases by 3.9 m of ice per 100 m in altitude. The discharge of ice near the lake and the annual balance further up-valley allow an estimate of the mean annual balance in the accumulartion zone (between 4,850 and 6,020 m) at 2.30 m of water per year. Until now no annual precipitation higher than 1 m/year had been measured in Cordillera Blanca, but this Cordillera includes many meso-climates. Eight successive moraines are found at Safuna. They are tentatively correlated with the eight existing between Huaraz and Laguna Llaca. Clapperton's 'group 4' was not formed during the 20th, but during the 17th century. His 'group 3' is not from A.D. 1750-1800, but is 5,000 to 7,000 years old, according to the offset of Cordillera Blanca great fault. (See also W78-02583 and W78-02584) (Humphreys-ISWS)
W78-02585

EXPERIMENTS ON THE ORIGIN OF KETTLE-HOLES,
University Coll., London, (England). Dept. of Geography.
J. K. Maizels.
Journal of Glaciology, Vol 18, No 79, p 291-303, 1977. 9 fig, 1 tab, 27 ref.

Descriptors: *Geomorphology, *Glaciology, *Potholes, *Laboratory tests, Ice, Glacial drift, Melting, Land forming, Model studies, Melt water, Land subsidence, Erosion, Topography, Analytical techniques, Foreign research, *Kettle-holes.

Several theories exist on the origin of kettle-holes in pro-glacial outwash deposits. The most widely accepted theory of origin involves the melting of buried ice. Some experiments were carried out in which ice blocks were placed on or in outwash sediments in a tank in order to determine which mechanisms of ice melt would be most likely to give rise to kettle-hole features. The largest kettle-holes were produced by the melting of buried ice blocks; smaller transient depressions, were formed from ice blocks melting in streams of flowing water; while, rather than depressions, ridges resembling pingos and moraines were created by ice blocks melting on a dry or saturated gravel surface. (Humphreys-ISWS)
W78-02586

SOUTHWARD DISPLACEMENT OF THE DISTRIBUTION OF GLACIATION DURING THE THREE MAXIMA OF THE LAST ICE AGE,
Stockholm Univ. (Sweden). Geologiska Institutionen.
N.-A. Morner.
Journal of Glaciology, Vol 18, No 79, p 305-308, 1977. 1 fig, 19 ref.

Descriptors: *Glaciation, *Geologic history, *Evaluation, Ice, Glaciology, Glacial drift, History, Pleistocene epoch, Last ice age, Laurentide ice sheet, Fennoscandian ice sheet.

The Laurentide and Fennoscandian ice sheets had three major glacition maxima during the Last Ice Age. All data from the southern margins of the ice sheets indicate that these maxima, as wells as minor fluctuations, were synchronous. The same synchroneity is supposed to apply also for correlations between fluctuations on the north and south margins, which reveal a continuously southward displacement of the distribution of glaciation during the Last Ice Age. This southward displacement explains the sawtooth pattern of 018 records from deep sea cores in which the first glaciation maximum is under-represented due to its distribution more towards the north. The synchroneity is consistent with a global climatic control of the stadial/interstadial changes and with the recorded global eustatic changes. The southward displacement of glaciation seems to be a general rule also applicable to earlier Pleistocene glaciations. (Humphreys-ISWS)
W78-02587

PLEISTOCENE MOUNTAIN GLACIATION IN ETHIOPIA,
Wisconsin Univ.-Madison. Dept. of Meteorology.
S. Hastenrath.
Journal of Glaciology, Vol 18, No 79, p 309-313, 1977. 4 fig, 9 ref.

Descriptors: *Glaciation, *Africa, *Geomorphology, Pleistocene epoch, Glacial drift, Surveys, On-site investigations, Exploration, Cirques, *Ethiopia.

During a field survey in High Semyen, northern Ethiopia, two moraine complexes were mapped, the lower one extending down to around 3,750 m. Glacial morphology is best developed in the northwestern and western quadrants. Moraines are deeply weathered and carry abundant vegetation. For Mounts Badda, Cilalo, Cacca, and Enguolo in southern Ethiopia, possible moraines are inferred from air photographs; there are indications for more pronounced glaciation in the western quadrant, and moraines seem to extend further down than in High Semyen. Highest moraines at Mount Elgon in northern Kenya, Uganda, were found to below 3,600 m. Major moraine complexes in the mountains of Ethiopia and East Africa suggest some spatial correlation in elevation and appearance, but absolute dates are absent. (Humphreys-ISWS)
W78-02588

TECHNIQUE FOR STUDYING STRUCTURE OF SEA ICE,
National Research Council of Canada, Ottawa (Ontario), Div. of Building Research.
N. K. Sinha.
Journal of Glaciology, Vol 18, No 79, p 315-323, 1977. 9 fig, 10 ref.

Descriptors: *Sea ice, *Laboratory tests, *Analytical techniques, Microscopy, Methodology, Instrumentation, Structures, Physical properties, *Microtoming, Microtechniques, Specimen preparation.

A microtoming and replicating technique was developed for examining the microstructure of sea ice optically and by scanning electron microscope. The dual observation method is useful for studying the grain and sub-grain structure of sea ice, the nature of the brine pockets, and the precipitation pattern of the salt crystals at low temperatures. (Humphreys-ISWS)
W78-02589

THE DISTRIBUTION OF GLACIERS IN THE ROCKY MOUNTAINS OF THE UNITED STATES,
Iowa Univ., Iowa City. Dept. of Geography.
W. L. Graf.
Journal of Glaciology, Vol 18, No 79, p 325-328, 1977. 1 fig, 1 tab, 12 ref.

Descriptors: *Glaciers, *Census, *Montana, *Wyoming, *Colorado, *Rocky Mountain Region, Ice, Size, Data collections, Surveys, Spatial distribution, Distribution.

Evidence from aerial photographs, maps, and field checks indicated that 319 glaciers lie in cirques of the Rocky Mountains, south of the United States-Canadian border. On a subcontinental scale, the distribution of glaciers is highly clustered, with larger and denser clusters located in the northern Rocky Mountains. Lesser concentrations of small glaciers occur in the southern Rocky Mountains. The total area of glaciers in the Rocky Mountains of the USA is 78.9 km. (Humphreys-ISWS)
W78-02590

AN ERROR IN ICE-TEMPERATURE MEASUREMENT,
British Antarctic Survey, Cambridge (England).
T. J. O. Sanderson.
Journal of Glaciology, Vol 18, No 79, p 329-333, 1977. 1 fig, 2 tab, 13 ref.

Descriptors: *Glaciers, *Temperature, *Measurement, *Mathematical models, Ice, Theoretical analysis, Polar regions, Equations, Boreholes, Heat flow, Variability, Thermal conductivity, Measurement error.

An analysis was made of the disturbance in conductive heat flow caused by drilling borehole in ice in which there is a vertical temperature gradient. The model used is that of a perfectly insulating hole placed in a linear temperature gradient; it was shown that the temperature measured at the bottom of the hole deviates from its value before drilling by an amount of the order -0.6aU where a is the borehole radius and U is the temperature gradient. The deviation takes effect in a few hours. The error is typically between 0.005 and 0.1 deg and, therefore, is significant only where very high accuracy is required. The error should not be present in temperate glaciers, nor where the thermometer is properly frozen in, nor if temperatures are measured at the borehole walls far above the bottom. (Humphreys-ISWS)
W78-02591

A COMPARISON OF THE CRREL 500 CU CM TUBE AND THE ILTS 200 AND 100 CU CM BOX CUTTERS USED FOR DETERMINING SNOW DENSITIES,
Colorado Univ., Boulder. Dept. of Geography; and Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
T. Carroll.
Journal of Glaciology, Vol 18, No 79, p 334-337, 1977. 1 fig, 1 tab, 7 ref. USBR 14-06-7155-3.

Descriptors: *Snow, *Density, *Measurement, Sampling, On-site tests, Instrumentation, Analytical techniques, Analysis.

The study indicated that no significant difference in snow densities is found when using either the CRREL (Cold Regions Research and Engineering Laboratory) tube or the ILTS (Institute of Low Temperature Science), Sapporo, Japan, box cutters. However, inexperienced workers tend to overestimate snow densities in light snow and depth hoar by 6 and 4% respectively. (Humphreys-ISWS)
W78-02592

FINAL REPORT-NATIONAL HAIL RESEARCH EXPERIMENT RANDOMIZED SEEDING EXPERIMENT 1972-1974, VOLUME I, EXPERIMENTAL RESULTS AND OVERALL SUMMARY,
National Center for Atmospheric Research, Boulder, CO.
For primary bibliographic entry see Field 3B.
W78-02603

FINAL REPORT-NATIONAL HAIL RESEARCH EXPERIMENT, RANDOMIZED SEEDING EXPERIMENT 1972-1974, VOLUME II, PRECIPITATION MEASUREMENTS,
National Center for Atmospheric Research, Boulder, CO.
For primary bibliographic entry see Field 3B.
W78-02604

2D. Evaporation and Transpiration

ECOLOGICAL-GEOGRAPHIC CHARACTERISTICS OF TREE TRANSPIRATION, (IN RUSSIAN),
O. N. Solntseva, and V. I. Sutulova.
Ekologiya 6(6), p 86-89, 1975.

Descriptors: *Transpiration(Trees), *Heat-moisture ratio(Trees), Aspen, Birch, Deserts, *Ecological distribution, Elm, Forests, Geography, Lime, Oak, Pine, Red ash, Norway maple.

Transpiration intensity of aspen, Norway maple, common birch, red ash, small-leaved lime, Scots pine, Norway spruce, pedunculate oak and common elm growing in forest, forest-steppe, steppe and semi-desert was studied. Dispersion data showed a decrease in transpiration intensity for most species toward the south. Environmental conditions had the least effect on elm and the highest on aspen and maple transpiration. The effect on birch, ash, lime, pine, spruce and oak decreased from 63-39%, respectively. Correlation between transpiration intensity and specific properties was highest in areas with high moisture supply and lowest in areas where the heat-moisture ratio was close to 1.--Copyright 1977, Biological Abstracts, Inc.
W78-02425

HEAT BALANCE IN A SMALL COASTAL INLET PAUATAHANUI INLET, NORTH ISLAND, NEW ZEALAND,
Department of Scientific and Industrial Research, Wellington (New Zealand). Oceanographic Inst.
For primary bibliographic entry see Field 2L.
W78-02596

SUMMER SOLAR RADIATION AND TEMPERATURE IN RELATION TO MONSOON RAINFALL,
Meteorological Office, Poona (India).
For primary bibliographic entry see Field 2B.
W78-02602

2E. Streamflow and Runoff

THE MOVEMENT OF SUSPENDED PARTICLES DUE TO SUDDEN RELEASE OF WATER FROM A LONG PRISMATIC FLUME,
Mississippi State Univ., Mississippi State. Dept. of Agricultural and Biological Engineering.
For primary bibliographic entry see Field 8B.
W78-02205

A COMPARISON BETWEEN CONVENTIONAL AND LANDSAT-BASED HYDROLOGIC MODELING: THE FOUR MILE RUN CASE STUDY,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W78-02232

URBAN STORM RUNOFF INLET HYDROGRAPH STUDY: VOL. 1, COMPUTER ANALYSIS OF RUNOFF FROM URBAN HIGHWAY WATERSHEDS UNDER TIME-AND SPACE-VARYING RAINSTORMS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 4D.
W78-02240

URBAN STORM RUNOFF INLET HYDROGRAPH STUDY: VOL. 2, LABORATORY STUDIES OF THE RESISTANCE COEFFICIENT FOR SHEET FLOWS OVER NATURAL TURF SURFACES,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 4D.
W78-02241

ENVIRONMENTAL MODEL OF KISSIMMEE RIVER BASIN,
Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
For primary bibliographic entry see Field 5B.
W78-02258

FLUCTUATIONS OF WET AND DRY YEARS, AN ANALYSIS BY VARIANCE SPECTRUM,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 2B.
W78-02263

TECHNIQUE FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 4A.
W78-02416

PRELIMINARY FLOOD-FREQUENCY RELATIONS FOR URBAN STREAMS, METROPOLITAN ATLANTA, GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W78-02423

MAP SHOWING DRAINAGE BASINS AND LOCATION OF STREAMFLOW-MEASURING SITES, FAIRFAX COUNTY, VIRGINIA,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02431

TECHNIQUES FOR ESTIMATING FLOOD DISCHARGES FOR OKLAHOMA STREAMS,
Geological Survey, Reston, VA; and Oklahoma City, OK. Water Resources Div.
For primary bibliographic entry see Field 4A.
W78-02436

THE SOIL MOISTURE COMPONENT OF MATHEMATICAL CATCHMENT SIMULATION MODELS,
Seven-Trent Water Authority, Birmingham (England).
For primary bibliographic entry see Field 2G.
W78-02598

PLANNING FOR URBAN STORMWATER CONTROL, (PART III),
Fell, Brusso, Bruton and Knowles, Inc., Tulsa, OK.
For primary bibliographic entry see Field 5G.
W78-02660

2F. Groundwater

ESTIMATION OF AQUIFER DIFFUSIVITY IN STREAM-AQUIFER SYSTEMS,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soil and Water Engineering.
S. R. Singh, and B. Sagar.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 103, No. HY11, Proceedings Paper 13362, p 1293-1302, November 1977. 1 fig, 2 tab, 18 ref.

Descriptors: *Diffusivity, *Aquifers, *Groundwater, *Mathematical models, *Streams, Equations, Hydrographs, Model studies, Aquifer characteristics, Water levels, Hydraulic gradient, *Boussinesq equation, *Sand tank models, Spline method.

By specifying an extra boundary condition in terms of hydraulic gradient at the stream-aquifer interface and by using the Green's function of the linearized Boussinesq equation, analytical solutions were developed to determine aquifer diffusivity explicily. Four different types of Dirichlet boundary condition describing stream gage hydrographs were empolyed. They were: (1) linearly rising water level in the stream; (2) exponentially rising water level in the stream; (3) water level represented by a sinusoid; and (4) hydrographs approximated by cubic splines. The last one is quite general and is capable of analyzing different shapes of smooth stream hydrographs expected to occur in nature. Hydraulic gradient at the interface was computed using splines. The solutions were validated by analyzing the stream-aquifer data observed in a sand tank model. They yielded consistent values of the aquifer diffusivity at different times and, therfore, are useful in determining the parameter of the aquifers contiguous to streams. (Visocky-ISWS)
W78-02250

GROUND WATER FAVORABILITY AND SURFICIAL GEOLOGY OF THE PORTLAND AREA, MAINE,
Geological Survey, Augusta, ME. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02413

SOLUTION OF THREE-DIMENSIONAL GROUND-WATER FLOW EQUATIONS USING THE STRONGLY IMPLICIT PROCEDURE,
Geological Survey, Reston, VA. Water Resources Div.
P. C. Trescott, and S. P. Larson.
Journal of Hydrology, Vol 35, No 1/2, p 49-60, October 1977. 6 fig, 17 ref, append.

Descriptors: *Model studies, *Groundwater movement, *Aquifer characteristics, *Numerical analysis, *Computer programs, Hydrogeology, Leakage, Hydraulic conductivity, FORTRAN IV, Finite-difference methods, Three-dimensional model.

A three-dimensional numerical model has been coded to use the strongly implicit procedure for solving the finite-difference approximations to the ground-water flow equation. The model allows for: (1) the representation of each aquifer and each confining bed by several layers; and (2) the use of an anisotropic hydraulic conductivity at each finite-difference block. The model is compared with a previously developed quasi-three-dimensional model by simulating the steady-state flow in an aquifer system in the Piceance Creek Basin, Colorado. The aquifer system consists of two aquifers separated by a leaky confining bed. The upper aquifer receives recharge from precipitation and is hydraulically connected to streams. In order to make a valid comparison of results, a single layer was used to represent each aquifer. The need for a layer to represent the confining bed was eliminated by incorporating the effects of vertical leakage into the vertical component of the anisotropic hydraulic conductivity of the adjacent aquifers. Thus, the problem was represented by only two layers in each model with a total of about 2,100 equations. This restricted the effects of flow in the confining layer to the vertical component, but simulations with a third layer in the three-dimensional model permitting horizontal flow in the confining bed show that the two-layer approach is reasonable. Convergence to a solution of this problem takes about one minute of computer time on the IBM/155. This is about 30 times faster than the time required using the quasi-three-dimensional model. (Woodard-USGS)
W78-02428

GROUND-WATER DATA FOR THE DREWSEY RESOURCE AREA, HARNEY AND MALHEUR COUNTIES, OREGON,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02430

PARTIALLY-SATURATED TRANSIENT GROUNDWATER FLOW MODEL THEORY AND NUMERICAL IMPLEMENTATION,
Montana Univ., Missoula. Dept. of Water and Land Resources.
For primary bibliographic entry see Field 2G.
W78-02453

INVESTIGATIONS OF THE DUNES GEOTHERMAL ANOMALY, IMPERIAL VALLEY, CALIFORNIA: PART 1, GEOCHEMISTRY OF GEOTHERMAL FLUIDS,
California Univ., Riverside. Inst. of Geophysics and Planetary Physics.
T. B. Coplen, and P. Kolesar.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-261 221, Price codes: A02 in paper copy, A01 in microfiche. August, 1974. 25 p, 3 fig, 18 ref.

Descriptors: *Geothermal studies, *Thermal water, *Geochemistry, Chlorides, Temperature, Stable isotopes, Dissolved solids, Salts, Wells, Brines, Aquifers, Fluid flow, *Salton Sea(California), Colorado River, Bromides.

In order to perform geochemical analyses of the Dunes Geothermal Anomaly in the Imperial Valley of California, the California Department of Water Resources drilled a 612-meter deep test well at the anomaly; fluid samples were subsequently studied by investigators at University of California, Riverside. Chemical and isotopic analysis of samples taken from perforations at 109 and 260 meters suggests that the source of the geothermal fluid is partially evaporated Colorado River water. Further investigation of chloride/bromide ratios indicates that the salt in the Salton Sea geothermal system is derived from the Colorado River, and that this water has not done any leaching nor been mixed with water from other sources. Additional geophysical studies are suggested to locate more precisely the reservoir of geothermal fluid in the Dunes area. (See also W78-02536) (Eberle-NWWA)
W78-02535

INVESTIGATIONS OF THE DUNES ANOMALY, IMPERIAL VALLEY, CALIFORNIA: PART II, PETROLOGICAL STUDIES,
California Univ., Riverside. Dept. of Earth Sciences.
W. A. Elders, and D. K. Bird.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-261 222, Price codes: A02 in paper copy, A01 in microfiche. June, 1974. 14 p, 3 fig, 1 tab, 8 ref.

Descriptors: *Geothermal studies, *Diagenesis, Sandstones, Brines, Heat flow, Geophysics, Surveys, Sedimentary rocks, Quartz, Shales, Permeability, *Salton Trough(California), *Silicification, Hydrothermal processes.

Several localized areas of very high temperature gradients at shallow depth occur within the Salton Trough, the landward extension of the Gulf of California rift system. A 612 meter deep test-well in the Dunes Anomaly indicates that there have been various stages of hydrothermal and diagenetic alteration of the silicified detaic sediments penetrated. Dense cap rock has developed in which seven distinct zones of intensive silicification were observed; highest temperatures recorded are all within shales and intensively silicified sands of low permeability. Evidence suggests that silicification was episodic. It appears that when moderately hot brines encountered colder rocks, precipitation of quartz and feldspar made the rocks impermeable; any further flow through such rocks was through later fractures. Thus, water-dominated systems which operate in porous sandstone are essentially self-sealing, and may have no surface expression. The silica cap rock nonetheless remains a good exploration target for geophysical surveys. (See also W78-02535) (Eberle-NWWA)
W78-02536

THE REPORT TO CONGRESS: WASTE DISPOSAL PRACTICES AND THEIR EFFECTS ON GROUND WATER.
Environmental Protection Agency, Washington, DC. Office of Water Supply.
For primary bibliographic entry see Field 5E.
W78-02537

SIMILARITY SOLUTIONS FOR CONVECTION OF GROUNDWATER ADJACENT TO HORIZONTAL IMPERMEABLE SURFACES WITH AXISYMMETRIC TEMPERATURE DISTRIBUTION
Hawaii Univ., Honolulu. Dept. of Mechanical Engineering.
P. Cheng, and W. C. Chau.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-261 559, Price codes: A03 in paper copy, A01 in microfiche. Hawaii Geothermal Project Technical Report No. 14, April, 1976. 20 p, 8 fig, 2 tab, 9 ref.

Descriptors: *Geothermal studies, *Convection, Groundwater, Flow, Permeability, Mathematics, Numerical analysis, Boundaries(Surfaces), Heat transfer, *Porous media, Axisymmetric temperature distribution.

The prediction of heat transfer rate from a heated or cooled horizontal surface to surrounding ground water has important applications to the assessment of geothermal resources and the design of a geothermal power plant. The problem can be idealized as a horizontal flat plate embedded in a saturated porous medium of infinite extent. Convection in a saturated porous medium and in an incompressible fluid have much in common, thus, it can be conjectured that convective heat transfer in a porous medium at high Rayleigh numbers takes place in a thin layer adjacent to the heated and cooled surfaces. In this paper, the axisymetric buoyancy induced flow in a saturated porous medium above a heated or below a cooled horizontal impermeable surface with prescribed wall temperature being a power function of the radius is studied. Using boundary layer simplifications, the governing non-linear partial differential equations can be transformed into a coupled pair of non-linear ordinary differential equations with two-point boundary conditions that can be integrated numerically by established techniques. Algebraic expressions obtained are useful for a quick estimate of geothermal resources in a given area. (Eberle-NWWA)
W78-02539

NEW SOURCES OF ENERGY: PROCEEDINGS OF THE CONFERENCE, VOLS. 2 AND 3, GEOTHERMAL ENERGY.
United Nations, New York.
For primary bibliographic entry see Field 4B.
W78-02541

GOVERNING EQUATIONS FOR GEOTHERMAL RESERVOIRS,
Systems, Science and Software, La Jolla, CA.
D. H. Brownell, Jr, S. K. Garg, and J. W. Pritchett.
Water Resources Research, Vol. 13, No. 6, p 929-934, December, 1977. 18 ref.

Descriptors: *Geothermal studies, *Numerical analysis, Heat transfer, Momentum transfer, Mass, Energy, Earth-water interfaces, Thermal water, Fluid mechanics, Equations, Balance laws, Constitutive relations, Rock-fluid systems.

In order to study problems characterized by essential alterations in a geothermal reservoir porous matrix, it is necessary to consider fully interacting rock-fluid systems. Examples of such problems include the interaction between pore collapse (subsidence) and fluid extraction rates, the reinjection of collapsed pores by condensate reinjection, and the effects of variations in natural mechanical forces on the state of the geothermal system. For geothermal reservoir applications where fluid velocities are low and times of interest are long, it is possible to simplify the general balance laws previously developed for solid-fluid mixtures. Thus, this paper presents the fully interactive equations for single-phase systems, possible simplifications for single-phase geothermal appplications, and extension to two-phase systems. These are followed by a discussion of constitutive relations. The system of governing equations outlined is quite complex and must be solved numerically. (Eberle-NWWA)
W78-02542

POSSIBLE CONTAMINATION OF GROUND WATERS BY OIL-AND GAS-WELL DRILLING AND COMPLETION FLUIDS,
Energy Research and Development Administration, Bartlesville, OK. Bartlesville Energy Research Center.
For primary bibliographic entry see Field 5B.
W78-02546

RESERVOIR EVALUATION TESTS ON RRGE 1 AND RRGE 2, RAFT RIVER GEOTHERMAL PROJECT, IDAHO,
California Univ., Berkeley. Lawrence Berkeley Lab.
For primary bibliographic entry see Field 4B.
W78-02549

ESTIMATING AQUIFER PERMEABILITY BY SURFACE ELECTRICAL RESISTIVITY MEASUREMENTS,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
W. E. Kelly.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-261 584, Price codes: A03 in paper copy, A01 in microfiche. August, 1976. 48 p, 16 fig, 3 tab, 28 ref.

Descriptors: *Electrical studies, *Resistivity, *Permeability, *Aquifers, Porosity, Water quality, Electrical properties, Geologic formations, Glacial drift, *Glacial aquifers, Formation factor, Schlumberger electrical survey method.

The object of this investigation was to develop surface electrical resistivity techniques for estimating the water bearing properties of glacial aquifers. Schlumberger electrical soundings were made at six sites in southern Rhode Island where pumping tests had previously been made. Measurements of electrical resistivity and permeability were also made concurrently in the laboratory using a modified falling head permeameter. The sounding curves were interpreted, and layer resistivities and formation factors (the latter computed from layer resistivities and measured specific conductances) were correlated with the permeabilities determined from pumping tests. It was determined that estimates of glacial aquifer permeability from surface resistivity measurements are feasible, and can be made by developing semi-empirical correlations between the apparent formation factor of the saturated zone and permeabilities from pumping tests. Water quality in terms of resistivity plays an important part in the computation of field formation factors as well as the interpretation of soundings for a given site. (Eberle-NWWA)
W78-02551

TWO-DIMENSIONAL SIMULATION OF THE RAFT RIVER GEOTHERMAL RESERVOIR AND WELLS,
EG and G Idaho, Inc., Idaho Falls.
For primary bibliographic entry see Field 4B.
W78-02552

GEOTHERMAL RESOURCES, EXPLORATION AND LXPLOITATION: A BIBLIOGRAPHY.
Department of Energy, Oak Ridge, TN. Technical Information Center.
For primary bibliographic entry see Field 8B.
W78-02553

2G. Water In Soils

WASTEWATER TREATMENT AND REUSE BY THE SOIL-PLANT SYSTEM,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5D.
W78-02223

URBAN STORM RUNOFF INLET HYDROGRAPH STUDY: VOL. 5, SOIL-COVER-MOISTURE COMPLEX: ANALYSIS OF PARAMETRIC INFILTRATION MODELS FOR HIGHWAY SIDESLOPES,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 4D.
W78-02244

PERSISTENCE OF SOME PHENYLAMIDE PESTICIDES IN THE AQUATIC ENVIRONMENT -- II. ADSORPTION ON CLAY MINERALS,
National Research Centre, Cairo (Egypt). Water Pollution Control.
For primary bibliographic entry see Field 5B.
W78-02264

DETECTION OF A POTENTIAL HEALTH HAZARD IN RECREATIONAL AND OTHER SURFACE WATERS,
Nebraska Univ. at Omaha. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W78-02405

PARTIALLY-SATURATED TRANSIENT GROUNDWATER FLOW MODEL THEORY AND NUMERICAL IMPLEMENTATION,
Montana Univ., Missoula. Dept. of Water and Land Resources.
A. E. Reisenauer, D. B. Cearlock, C. A. Bryan, and G. S. Campbell.
Available from the National Technical Information Service, Springfield, VA 22161 as BNWL-1713, Price codes: A03 in paper copy, A01 in microfiche. Report BNWL-1713, Battelle Pacific Northwest Laboratories, Richland, Washington, 1975. 55 p, 9 fig, 1 tab, 27 ref, 2 append.

Descriptors: *Unsaturated flow, *Groundwater, *Computer models, *Simulation analysis, Porous media, Soils, Sediments, Hydraulics, Numerical analysis, Equations, Systems analysis, Finite difference approximation, Iterative technique.

Described is the mathematical development of a computer model, the Partially-Saturated Transient Flow Model (PST), used to test the formulation for simulating isothermal, unsaturated, liquid flow in heterogeneous porous media. The fundamental equations and assumptions applying to the model are discussed, and problems encountered in modeling the flow in soils with water contents less than saturation are delineated. Because of the nonlinearities of the descriptive equations, finite difference approximation and an iterative technique were used to obtain solutions. The model, when tested, was computationally slow and impractical as a management tool but did demonstrate that the equation could be solved for flow entering relatively dry soils. Several methods of dealing with the sediment hydraulic characteristics were tested. (Bell-Cornell)
W78-02453

EFFECT OF CHEMICAL AMELIORATION ON BIOLOGICAL PROCESSES IN SOLONETZ SOIL AT DIFFERENT IRRIGATION LEVELS, (IN RUSSIAN),
Moskovskaya Selskokhozyaistvennaya Akademiya (USSR). Div. of Soil Science.
N. P. Panov, L. V. Mosina, N. A. Goncharova, N. S. Odinokova, and K. Salekh.
Izv Timiryazev S-Kh Akad 4, p 134-140, 1976.

Descriptors: *Bacteria, Irrigation practices, *Solonetz soils, Actinomyceter, Ammonia bacteria, Cacillus-cereus, Bacillus-idosus, Bacillus-megaterium, Gypsum, Microorganisms, Nitrification, Spore-forming bacteria.

Excessive irrigation in the form of 2-3 mo. flooding decreased the number of ammonizing bacteria and increased number of spore-forming bacteria. The decrease in Bacillus megaterium and B. idosus and increase in B. cereus cells indicated significant decrease in energy of nitrification processes. Gypsum and gypsum in combination with straw as meliorants stimulated growth of all microorganisms and had a positive effect on nitrification and mineralization. Ferrous sulfate inhibited growth. Group composition of actinomycetes was largest in gypsum-straw melioration.--Copyright 1978, Biological Abstracts, Inc.
W78-02499

DETERMINATION OF CARAGARD IN WATER, SOIL AND PLANT MATERIAL BY THIN LAYER CHROMATOGRAPHY, (IN RUSSIAN),
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Gigieni i Toksikologii Pestitsidov, Kiev (USSR).
For primary bibliographic entry see Field 5A.
W78-02533

STUDY OF WATER-SOLUBLE ORGANIC SUBSTANCES IN NATURAL WATER USING GEL CHROMATOGRAPHY, (IN RUSSIAN),
Moskovskaya Selskokhozyaistvennaya Akademiya (USSR), Div. of Soil Science.
For primary bibliographic entry see Field 5A.
W78-02555

SOME ASPECTS OF THE FIELD WATER CYCLE AFFECTED BY SOIL SURFACE CONDITIONS,
Hebrew Univ., Rehovoth (Israel). Dept. of Soil and Water Science.
D. Hillel.
Meded Fac Landbouwwet Rijksuniv Gent. 37(3), p 1114-1131, 1972.

Descriptors: *Soil surfaces, *Percolation, *Induced infiltration, *Soil management, Infiltration, Seepage, Evapotranspiration, Evaporation, Soil properties, Water conservation, Water utilization, Evaporation, Infiltration, Soils.

Water added to soil can either infiltrate, accumulate on the surface or form surface runoff. Infiltrated water is eventually divided between seepage and evapotranspiration. Many attempts have been made to modify the soil surface ozone with the aim of promoting infiltration and suppressing evaporation. This paper analyzes the possibilities for beneficial modification of surface properties to achieve more effective control, conservation and utilization of water in the field.--Copyright 1974, Biological Abstracts, Inc.
W78-02577

THE SOIL MOISTURE COMPONENT OF MATHEMATICAL CATCHMENT SIMULATION MODELS,
Seven-Trent Water Authority, Birmingham (England).
R. E. Manley.
Journal of Hydrology, Vol. 35, No. 3/4, p 341-356, November 1977. 5 fig, 4 tab, 19 ref.

Descriptors: *Watersheds(Basins), *Runoff, Flow, *Model studies, Mathematical models, Soil moisture, Infiltration, Permeability, Overland flow, Precipitation(Atmospheric), Rainfall, Soil water movement, Percolation, Evapotranspiration, Groundwater, Channel flow, Hydrology.

The role of soil moisture in mathematical catchment simulation models was discussed, and requirements for this component of the model were suggested. A model was described which embodies the suggested characteristics, particular emphasis being placed on its soil moisture component. The results from the application of this model were presented. (Sims-ISWS)
W78-02598

NONLINEAR ADSORPTION IN POROUS MEDIA WITH VARIABLE POROSITY,
Melbourne Univ., Parkville (Australia). Dept. of Chemical Engineering.
S. H. Lin.
Journal of Hydrology, Vol. 35, No. 3/4, p 235-243, November 1977. 6 fig, 17 ref.

Descriptors: *Porous media, *Adsorption, *Dispersion, *Model studies, Mathematical models, Solutes, *Porosity, Seepage, Soil water, Soil water movement, Nutrients, Nutrient removal, Nitrogen, Phosphorus, Liquid wastes, Path of pollutants, Soil properties.

A numerical procedure was presented for predicting the solute dispersion and adsorption in heterogeneous porous media. Several porosity equations with decreasing or increasing porosity were proposed to represent the porosity variation and were used to simulate how the porosity variation affects the solute concentration distribution. The solute responses subject to a step change or

an exponential change input revealed some interesting characteristics. (Sims-ISWS)
W78-02599

EFFECTS OF FINE-PARTICLE AMENDMENTS ON THE SOIL MOISTURE CHARACTERISTICS OF A GRAVELLY SANDY LOAM AND ON CROP YIELDS,
National Vegetable Research Station, Wellesbourne (England).
D. A. Stone.
J Agric Sci. 81(2), p 303-310, 1973.

Descriptors: *Soil amendments, *Crop production, *Moisture availability, *Topsoil, Soil treatment, Soil moisture, Crop response, Sands, Loam, Gravels, Evaporation, Ashes.

Pulverized fuel ash and fluidized combustor ash were used to modify the available-water capacity and moisture characteristics of a gravelly sandy loam soil in a study of the effects of fine-particle amendments on crop yield. Intimate incorporation of the ashes into the top-soil at rates of up to 502t(tons)/ha increased the available water retained in the surface 0.3 m of soil by 40-80%. The increase was mainly water held at potentials of between -0.05 bar and -1 bar. Two sugar beet crops followed by broad beans, salad onions and cabbage were grown in the amended soil. With the highest rate of ash addition yield of the onions was increased by over 30% and of the cabbages by 14%. No improvement in sugar beet or broad bean yields resulted from the treatment. Poor growth of the 2nd sugar beet crop was attributed to a reduced aeration effect but it is suggested that the failure of the increased available water to improve yield consistently in this and a previous experiment was in part caused by rapid evaporative losses from the amended soil.--Copyright 1974, Biological Abstracts, Inc.
W78-02626

PRELIMINARY RESULTS OF UHF RADIOMETRIC AND DIRECT GROUND STUDIES OF SOIL MOISTURE IN 1975,
A. Ye. Basharinov, I. M. Butenko, L. A. Parshina, Ye. A. Reutov, and A. A. Chukhlantsev.
Available from the National Technical Information Service, Springfield, VA 22161 as N76 23785, Price codes: A02 in paper copy, A01 in microfiche. NASA Technical Translation F-17053, May 1976. 18 p, 11 fig, 10 ref. NASA NASw-2792.

Descriptors: *Remote sensing, *Soil moisture, *Irrigation, Aircraft, Rainfall, Crops, On-site data collections, Measurement, Radiation, Soils, Temperature, Equipment, Instrumentation, Agriculture, *USSR, Radiometers.

Data regarding measurement regions of the study, characteristics of weather conditions, methods and certain data of ground measurements of soil parameters, UHF radiometric equipment, tasks and methods of measurements, and the certain results of integrated measurements were investigated. Figures include location of measurement regions, characteristics of the state of a number of fields in the agricultural region, characteristic profiles on relative humidity, data of spatial variations in radiobrightness on the wave of 3.4 cm and results of ground measurements of relative humidity, data on profile measurements, dependence of soil emissivity, and spectral dependence of the degree of radiobrightness decrease over the region of groundwater on the Arabat spit. (Sims-ISWS)
W78-02684

SILVER IN SOILS, STREAM SEDIMENTS, WATERS, AND VEGETATION NEAR A SILVER MINE AND TREATMENT PLANT AT MARATOTO, NEW ZEALAND,
Massey Univ., Palmerston North (New Zealand). Dept. of Chemistry, Biochemistry and Biophysics.
For primary bibliographic entry see Field 5B.
W78-02700

2H. Lakes

BIOLOGICAL AND WATER QUALITY EFFECTS OF WHOLE LAKE MIXING,
Oklahoma State Univ., Stillwater. School of Biological Sciences.
For primary bibliographic entry see Field 5G.
W78-02203

PRELIMINARY ECOLOGICAL STUDY ON THE PERIPHYTIC AND BENTHONIC DIATOMS AS FOOD OF LACUSTRINE AMPHIPODS (LAKE CARDIEL, PROV. SANTA CRUZ), (IN SPANISH),
L. Luchini.
Physis Secc B Aguas Cont Org 34(89), p 85-97, 1975.

Descriptors: *Ecology, *Periphyton, *Benthos, Amphipods, *Argentina(Lake Cardiel), *Diatoms, Ecological distribution, Food chains, Hyalella-fossamancinii, Lacustrine, Lakes, Rupia-cirrhosa.

The epiphytic diatom flora of Rupia cirrhosa in Cardiel Lake (Argentina) was studied. The stomach contents of the amphipod Hyalella fossamancinii were determined, and they appear to be strongly related to the periphyton and the phytobenthos. This amphipod plays an important role in the food chain of the lake. Forty-five entities (species and varieties) were determined, the ologohalobian, alkaline and bottom littoral forms prevailing.--Copyright 1977, Biological Abstracts, Inc.
W78-02216

INTERACTION OF SOLUBLE PHOSPHATE WITH ALUMINUM HYDROXIDE IN LAKES,
Wisconsin Univ.-Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 5C.
W78-02222

ICE RIDGE FORMATION: PROBABLE CONTROL BY NEARSHORE BARS,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
For primary bibliographic entry see Field 2C.
W78-02254

SEDIMENT PREDICTION IN THE EASTERN UNITED STATES,
North Carolina State Univ. at Raleigh. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W78-02259

AVAILABILITY AND CONCENTRATION OF POLLUTANTS FROM AMERICAN FALLS RESERVOIR SEDIMENTS TO FORAGE AND PREDACEOUS FISHES,
Idaho State Univ., Pocatello.
For primary bibliographic entry see Field 5B.
W78-02265

OBSERVATIONS ON THE STATUS OF THE DEVIL'S HOLE PUPFISH IN THE HOOVER DAM REFUGIUM,
Nevada Univ., Las Vegas. Dept. of Biological Sciences.
For primary bibliographic entry see Field 8I.
W78-02268

THE LAKE TROUT OF TWIN LAKES, COLORADO,
Colorado Cooperative Fishery Unit, Fort Collins.
For primary bibliographic entry see Field 8I.
W78-02269

ECOLOGY OF MYSIS RELICTA IN TWIN LAKES, COLORADO,
Colorado Cooperative Fishery Unit, Fort Collins.
For primary bibliographic entry see Field 8I.
W78-02270

THE DELINEATION OF A POINT SOURCE PLUME BY THE STUDY OF BACTERIAL POPULATIONS,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W78-02392

ASSESSMENT OF AQUATIC VEGETATION WITH SATELLITE-DERIVED DATA,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
B. L. Markham, W. R. Philipson, J. Ng, and T. Liang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 768, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, November 1977. 16 p, 3 fig, 6 tab, 15 ref. OWRT A-082-NY(1), 14-34-0001-7068.

Descriptors: *Remote sensing, *Aquatic plants, *Satellites(Artificial), Data processing, Freshwater, *New York, Lakes,
Identifiers: *Landsat data, Multispectral Scanner Data.

Landsat satellite data were analyzed manually and digitally to determine whether they can provide any useful information concerning freshwater, aquatic vegetation. The study focused on central New York State, where aerial photographic coverage and field data for three lakes were available for comparison. With certain limitations, the Landsat digital data could be analyzed to chart the distribution of emergent and floating vegetation; surfaced, submersed vegetation; and, in shallower waters, below-surface, submersed vegetation. The reliability with which submersed vegetation could be identified was generally lower than that associated with emergent and floating vegetation. The most serious limitation was experienced along shorelines. Here, because of Landsat's resolution, aquatic vegetation and the land-water interface may be imaged inseparately in the same pixel.
W78-02401

HYDRAULIC MODELING OF THE RESERVOIR, LOCAL DESTRATIFICATION PHENOMENON,
Oklahoma State Univ., Stillwater. School of Mechanical and Aerospace Engineering.
For primary bibliographic entry see Field 5G.
W78-02403

DETECTION OF A POTENTIAL HEALTH HAZARD IN RECREATIONAL AND OTHER SURFACE WATERS,
Nebraska Univ. at Omaha. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W78-02405

EVALUATION OF CHEMICAL, BIOLOGICAL, AND PHYSICAL CONDITIONS IN THE WINTER HAVEN CHAIN OF LAKES, FLORIDA, MARCH-JUNE 1976,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5A.
W78-02435

STATISTICAL MODELS OF RIVER LOADINGS OF NITROGEN AND PHOSPHORUS IN THE LOUGH NEAGH SYSTEM,
Northern Ireland Dept. of Agriculture, Antrim. Freshwater Biological Investigation Unit.
For primary bibliographic entry see Field 5B.
W78-02441

IMPACTS OF MAN'S ACTIVITIES ON THE CHEMICAL COMPOSITION IN THE SEDIMENTS OF LAKES ONTARIO, ERIE AND HURON,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W78-02464

THE PROBLEM OF THE SANITARY PROGNOSIS OF THE WATER QUALITY OF THE NIZHNEKAMSK RESERVOIR, (IN RUSSIAN),
Kazan Inst. of Porsgraduate Medicine (USSR).
For primary bibliographic entry see Field 5C.
W78-02468

MICROBIOLOGICAL STUDIES OF THE WANDA LAKE (ANTARCTICA), (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Inst. Mikrobiologii.
For primary bibliographic entry see Field 5C.
W78-02469

EFFECT OF FERTILIZERS ON THE NUMBER OF BACTERIA INVOLVED IN THE NITROGEN CYCLE IN POND WATER OF THE ASTRAKHAN OBLAST, (IN RUSSIAN),
Kaspiiskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Astrakhan (USSR).
For primary bibliographic entry see Field 5C.
W78-02475

STUDIES ON PRIMARY PRODUCTION IN THE GREEN GIRDLE OF NEUSIEDLER LAKE: I. CAREX RIPARIA CURT, (IN GERMAN),
Vienna Univ. (Austria). Pflanzenphysiologishches Inst.
For primary bibliographic entry see Field 5C.
W78-02476

PRELIMINARY BIOCHEMICAL OBSERVATIONS OF FISHES INHABITING AN ACIDIFIED LAKE IN ONTARIO, CANADA,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 5C.
W78-02486

NUTRIENT-ALGAL RELATIONSHIPS IN LAKE LILLINONAH, DANBURY, CONNECTICUT, JUNE-SEPTEMBER, 1975.
National Enforcement Investigations Center, Denver, CO
For primary bibliographic entry see Field 5C.
W78-02488

RELEASE OF DISSOLVED ORGANIC MATTER BY PHOTOSYNTHESIZING ALGAE IN LAKE KINNERET, ISRAEL,
Kinneret Limnological Lab., Tiberias (Israel).
For primary bibliographic entry see Field 5C.
W78-02492

SPECIFIC ASSOCIATION OF THE BLUEGREEN ALGAE ANABAENA AND APHANIZOMENON WITH BACTERIA IN FRESHWATER BLOOMS,
Department of Scientific and Industrial Research, Taupo (New Zealand).
For primary bibliographic entry see Field 5C.
W78-02493

THE IMPORTANCE OF ALLOCHTHONOUS PARTICULATE CARBON PATHWAYS IN A SUBALPINE LAKE,
Washington Univ., Seattle. Fisheries Research Inst.
For primary bibliographic entry see Field 5C.
W78-02496

CHRONOLOGY OF ORGANOCHLORINE COMPOUNDS IN LAKE MICHIGAN FISH, 1929-66,
Wisconsin Univ.-Madison. Dept. of Wildlife Ecology.
For primary bibliographic entry see Field 5A.
W78-02497

WATERFOWL AS INDICATOR FOR THE ECOLOGICAL QUALITY OF LAKES, (IN GERMAN),
For primary bibliographic entry see Field 5A.
W78-02501

CHEMICAL AND MINERALOGICAL COMPOSITION OF THE SEDIMENTS OF LAKES WITH LOW BIOLOGICAL PRODUCTIVITY, (IN ESTONIAN),
Akademiya Nauk Estonskoi SSR, Tartu. Inst. of Zoology and Botany.
For primary bibliographic entry see Field 5A.
W78-02504

NUTRIENT CYCLING AND PRODUCTIVITY OF DYSTROPHIC LAKE-BOG SYSTEMS (PART A), APPENDIX C: MAT-WATER EXCHANGE IN A STRATIFIED BOG LAKE,
Michigan Univ., Ann Arbor. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W78-02510

MATHEMATICAL MODELING OF DISPERSION IN STRATIFIED WATERS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W78-02511

A BIOLOGICAL AND CHEMICAL COMPARISON OF VARIOUS AREAS OF A RESERVOIR,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
For primary bibliographic entry see Field 5C.
W78-02514

WAVES GENERATED BY HORIZONTAL OSCILLATIONS IN BAYS,
Tetra Tech, Inc., Pasadena, CA. Engineering Div.
For primary bibliographic entry see Field 8B.
W78-02600

COASTAL CHANGES, EASTERN LAKE MICHIGAN, 1970-73,
Western Michigan Univ., Kalamazoo.
For primary bibliographic entry see Field 2J.
W78-02609

SHORELINE AND BATHYMETRIC CHANGES IN AND AROUND UPPER SANDUSKY BAY SINCE 1905,
Ohio Dept. of Natural Resources, Sandusky. Div. of Geological Survey.
For primary bibliographic entry see Field 5C.
W78-02651

FURTHER COLONIZATION AND ACCLIMATIZATION OF MONODACNA COLORATA EICHW. AND MONODACNA PONTICA EICHW. IN INLAND WATERS, (IN RUSSIAN),
Dnepropetrovskii Gosudarstvennyi Univ. (USSR). Inst. of Hydrobiology.
P. A. Zhuravel'.
Gidrobiol Zh 11(3), p 78-79, 1975.

Descriptors: *Acclimatization, Canal, *Colonization, Commercial fish, Feeding, Fish, *Inland waters, Lakes, *Mineralization, *Monodacna-colorata, *Monodacna-pontica, Ponds, Reservoirs, USSR.

Data indicating the prospects for acclimatization of the mollusks M. colorata and M. Pontica in lakes, reservoirs, ponds and canals of the USSR with high mineralization of the water (not less than 0.5 g/l) are presented. The mollusks have food value for commercial fishes, and their larvae (veligers) serve as food for youngfish; the mollusks are efficient filter feeders.--Copyright 1976, Biological Abstracts, Inc.
W78-02658

RESTORATION OF WATER QUALITY IN LAKE WESTON, ORLANDO, FLORIDA,
Orange County Pollution Control Dept., Orlando, FL.
For primary bibliographic entry see Field 5G.
W78-02678

2I. Water In Plants

THE COMPOSITION OF THE BENTHIC FAUNA OF A CROSS SECTION OF THE CLAMOUZE STREAM (HAUTE AUVERGNE, FRANCE), (IN FRENCH)
Rijksinstituut voor Natuurbeheer, Leersum (Netherlands).
L. W. G. Higler.
Ann Stn Biol Besse-en-Chandesse 9, p 219-224, 1974.

Descriptors: *Benthic fauna, Clamouze, Diptera, Ephemeroptera, *France(Clamouze stream), Larvae, Mud, Rocks, Streams, Trichoptera.

The site chosen for study was at an altitude of about 1000 m. The stream was about 3 m wide and 60 cm deep at the deepest point. Samples were taken at 4 different places across the stream in places with different exposure to the water flow, with 3 locations on rocky substrate and 1 on the mud bottom. The fauna at the different locations are tabulated. Ephemeroptera, Trichoptera and Diptera larvae are the most abundant groups found.--Copyright 1977, Biological Abstracts, Inc.
W78-02219

ASSESSMENT OF AQUATIC VEGETATION WITH SATELLITE-DERIVED DATA,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2H.
W78-02401

ECOLOGICAL-GEOGRAPHIC CHARACTERISTICS OF TREE TRANSPIRATION, (IN RUSSIAN),
For primary bibliographic entry see Field 2D.
W78-02425

VEGETATION TYPES IN AN IRREGULARLY FLOODED SALT MARSH ON THE NORTH CAROLINA OUTER BANKS,
North Carolina State Univ. at Raleigh. Dept. of Botany.
For primary bibliographic entry see Field 2L.
W78-02461

MODERATE-TERM WATER STRESSES AND ASSOCIATED CHANGES IN SOME PHOTOSYNTHETIC PARAMETERS IN COTTON,
Agricultural Research Council, Trumpington (England).
H. G. Jones.
New Phytol. 72(5), p 1095-1105, 1973.

Descriptors: *Photosynthesis, Cotton, Stomata, *Moisture stress, *Water stress.

Cotton plants (Gossypium hirsutum L., cv. 'Deltapine smoothleaf') were subjected to 1- or 2-

wk periods of mild water stress using an osmotic soil cell. The treatments were severe enough to affect seriously several photosynthetic parameters, while good night-time recovery of plant water-potential minimized effects on development and lead expansion. Most measurements were made soon after rewatering, owing to very high stomatal resistances in the stressed plants. The stressed plants had lower rates of potential photosynthesis and lower rates of actual photosynthesis (at normal ambient CO2 concentrations) than the controls. Both stomatal and intracellular resistances and the corresponding 'photosynthetic limitations' were greater in the stressed plants than the controls. Most of these parameters showed fairly complete recovery 24 h after rewatering. Parallel changes were observed in the activities of carbonic anhydrase, ribulosediphosphate carboxylase and 14C fixation by leaf slices, all of which were lower in the stressed plants. Although activities of all the processes studies showed parallel changes, there was evidence that the major factor causing reduced photosynthesis in the stressed plants was stomatal closure. There was some evidence that the photosynthetic system adjusted itself to water stress over the periods studied.--Copyright 1974, Biological Abstracts, Inc.
W78-02462

AN ANALYTICAL STUDY ON THE ECOPHYSIOLOGICAL ADAPTATION OF SOYBEAN PLANTS TO LIMITED WATER SUPPLY,
Tokyo Univ. (Japan). Dept. of Botany.
I. Furuhata, and M. Monsi.
J Fac Sci Univ Tokyo Sect III Bot. 11(7), p 243-262, 1973.

Descriptors: *Adaptation, *Soybeans, *Plant growth, *Moisture deficit, Soil moisture, Transpiration, Water balance, Water requirements, Leaves, Leaf/root ratio.

The plants (Glycine max) were grown in pots with moist sand (M: 22.8% on a dry weight basis) or with dry sand (D: 5.2%). Some of the M pots were changed in their soil moisture from M to D condition at different growth stages (M-to-D plants), and vice versa (D-to-M plants). The growth and transpiration of these plants were followed in details. The leaf area growth of the M-to-D plants was inhibited in younger stages of plants. In the later stages when the difference in leaf area between the M and D plants became considerable, the leaves at the lower position were defoliated in a few days after the transfer; and the total area of living leaves of the M-to-D plants approximated eventually to that of the D. Transpiration rate and relative turgidity of leaves were somewhat higher in the M plants than in the D plants. The transpiration rate of the M-to-D plants was decreased, and the water saturation deficit in leaves was increased suddenly to the similar values of the D plants immediately after the soil moisture treatment was completed. A parallel change was observed between the decrease of relative leaf area and the increase of relative transpiration rate; the relative values were indicated respectively in percentages for those of the D plants. Similar results were obtained with Helianthus tuberosus. The soil moisture strongly influenced the leaf/root ratio in dry weight and the distribution ratio of assimilates of the soybean seedlings. The leaf/root ratios of the M-to-D and D-to-M plants indicated tendencies to approach to the ratios of the D plants and M plants, respectively. A competitive relationship between the distribution ratio for leaves and roots was clearly observed in the M-to-D and D-to-M plants.--Copyright 1974, Biological Abstracts, Inc.
W78-02465

INTERSTITIAL SALINITY AS A CAUSE OF ECOPHENIC VARIATION IN SPARTINA ALTERNIFLORA,
Georgia Univ., Athens. Inst. of Ecology.
For primary bibliographic entry see Field 2L.
W78-02594

2J. Erosion and Sedimentation

THE MOVEMENT OF SUSPENDED PARTICLES DUE TO SUDDEN RELEASE OF WATER FROM A LONG PRISMATIC FLUME,
Mississippi State Univ., Mississippi State. Dept. of Agricultural and Biological Engineering.
For primary bibliographic entry see Field 8B.
W78-02205

INVENTORY OF SEDIMENT SAMPLE COLLECTION STATIONS IN THE MISSISSIPPI RIVER BASIN,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Mobility and Environmental Systems Lab.
M. P. Keown, E. A. Dardeau, Jr., and J. G. Kennedy.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-039 571, Price codes: A21 in paper copy, A01 in microfiche. Technical Report M-77-1, March 1977. 495 p, 163 fig, 3 tab, 108 ref, 1 append.

Descriptors: *Mississippi River Basin, *Sediments, *Sampling, Data collections, Data processing, Surveys, Sedimentation, Rivers, Potamology, Sediment transport, Sediment yield, Sediment discharge, Suspended solids, Sediment distribution, Sedimentology.

An inventory of the sediment sample collection stations in the Mississippi River Basin pertinent to the mission of the Corps of Engineers was conducted; 433 stations were located. Data for the 433 stations were presented in tables. For stations on the Arkansas, Atchafalaya, Kansas, Mississippi, Missouri, Ohio, Old, and Red river, the data included the river mile, water resource region, Corps of Engineers (CE) District, Office of Water Data Coordination (OWDC) station number, station name, geographic coordinates of the station location, type of water body on which the station is located, period of record of the station, frequency and types of data collected at the station, method used to collect sediment samples, and agency reporting to the OWDC regarding sediment collection activities at the station. For other streams in the basin on which stations are located, the data in the tables included the CE District, OWDC station number, station name, period of record, and agency reporting to the OWDC. In addition, narrative summaries were prepared for 74 key stations selected on the basis of location, period of record, and reliability of reported data. The summaries were presented in Appendix A and included information on the station site location, the collection and laboratory analysis of sediment samples taken at the station, and the reduction and reporting of the resulting data. (Sims-ISWS)
W78-02230

DEBRIS OF THE CHENA RIVER,
Cold Regions Research and Engineering Lab., Fairbanks, AK. Alaska Projects Office.
T. McFadden, and M. Stallion.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-029 357, Price codes: A02 in paper copy, A01 in microfiche. Report 76-26, July 76. 18 p, 17 fig, 3 tab, 5 ref, 1 append.

Descriptors: *Rivers, *Alaska, *Trees, Surveys, Measurement, Hazards, Floods, Erosion, Soil erosion, Banks, Bank erosion, Forests, Streamflow, Dams, Damsites, *Chena River(Alaska), *River debris, Log jams, Logs.

Debris over a 44-mile stretch of the Chena River was studied. The study area extended from the first bridge on the Chena Hot Springs Road to the Chena River Flood Control damsite. The purpose of the study was to assess the potential danger to the Chena River Flood Control Dam outlet structure. Debris was cataloged, log jams were measured, and sources of debris were studied. The average size of logs was determined, as well as the number of logs present on the river. It was concluded that a serious debris problem existed and would remain serious for the foreseeable future. Recommendations for debris handling were made. (Sims-ISWS)
W78-02238

BEACH EROSION DURING MINOR STORM,
South Carolina Univ., Columbia. Dept. of Geology.
For primary bibliographic entry see Field 2L.
W78-02246

EFFECT OF SEDIMENT GRADATION ON CLEAR WATER SCOUR,
Auckland Univ. (New Zealand). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W78-02248

BEDLOAD TRANSPORT BY TRANSLATION WAVES,
Ministry of Works and Development, Christchurch (New Zealand). Water and Soil Research.
For primary bibliographic entry see Field 8B.
W78-02249

STATISTICAL PROPERTIES OF SEDIMENT BED PROFILES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
H. W. Shen, and H. F. Cheong.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 103, No. HY11, Proceedings Paper 13348, p 1303-1321, November 1977. 7 fig, 4 tab, 25 ref.

Descriptors: *Statistics, *Beds, *Profiles, Bed load, Channels, Alluvial fans, Flow resistance, Hydraulics, Sediments, Sediment transport, Rivers, Flow, Alluvial deposits, Bed forms, Statistical analysis, Propagating waveforms.

Approximate relationships were derived from the spatial and frequency spectra of a system of propagating waveforms based on the assumption that such a system is represented adequately by a Gaussian random function. Spectral similarity among the bed form data from the field and laboratory was examined, but the results cannot be construed to be conclusive in light of some uncertainties. A bed load transport relationship based on the mean velocity of the shifting waveforms was presented and compared favorably with measured results considering the expected variabilities in sediment transport studies. (Lee-ISWS)
W78-02251

SETTLEMENT OF SOLID PARTICLES IN OPEN-CHANNEL FLOW,
Technical Univ. of Istanbul (Turkey). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W78-02252

SEDIMENT PREDICTION IN THE EASTERN UNITED STATES,
North Carolina State Univ. at Raleigh. Dept. of Civil Engineering.
H. R. Malcolm, Jr, and C. Smallwood, Jr.
Journal of the Water Resources Planning and Management Division, American Society of Civil Engineers, Vol. 103, No. WR2, Proceedings Paper 13340, p 285-298, November 1977. 6 fig, 2 tab, 13 ref, 2 append.

Descriptors: *Sedimentation, *Streams, *Lakes, *Model studies, Mathematical models, Equations, Urbanization, Drainage, Erosion, Forecasting, Planning, Channels, Lake sediments, Deposition(Sediments), Sediment discharge, Sediment transport, Watersheds(Basins), Erosion, Sedimentology, Lake capacity, Lake life.

Sediment discharge equations were derived for wooded, rural, urban, and severely exposed watersheds on the East Coast. The equations were used to model the impact of urbanization on sedimentation activity. The equations can be used in crude, but reasonably effective, modeling techniques to study some impacts of urbanization on streams and lakes. The equations confirmed and quantified the existence of a two-part urban sedimentation problem: one associated with erosion of denuded areas, and the other with the degradation of stream channels rendered unstable by extensive watershed changes. Two studies compared results with historical cases. (Sim-ISWS)
W78-02259

MULTICHANNEL SEISMIC REFLECTION PROFILES OF THE CONTINENTAL CRUST BENEATH THE NEWFOUNDLAND RIDGE,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia).
For primary bibliographic entry see Field 2L.
W78-02260

EXPERIMENTAL STUDY OF DRAINAGE BASIN EVOLUTION AND ITS HYDROLOGIC IMPLICATIONS,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 4D.
W78-02262

HYDROLOGIC CONSIDERATIONS ASSOCIATED WITH DREDGING SPRING PONDS IN WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 4D.
W78-02421

METHODS FOR DETERMINATION OF RADIOACTIVE SUBSTANCES IN WATER AND FLUVIAL SEDIMENTS,
Geological Survey, Lakewood, CO. Water Resources Div.; and Colorado School of Mines, Golden.
For primary bibliographic entry see Field 5A.
W78-02429

WATER-QUALITY STUDY OF TULPEHOCKEN CREEK, BERKS COUNTY, PENNSYLVANIA, PRIOR TO IMPOUNDMENT OF BLUE MARSH LAKE,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W78-02433

IMPACTS OF MAN'S ACTIVITIES ON THE CHEMICAL COMPOSITION IN THE SEDIMENTS OF LAKES ONTARIO, ERIE AND HURON,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W78-02464

ANAEROBIC DECOMPOSITION OF OIL IN BOTTOM SEDIMENTS,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Environmental Resources.
For primary bibliographic entry see Field 5B.
W78-02466

OXYGEN CONSUMPTION BY FRESHWATER SEDIMENTS,
Clemson Univ., SC. Dept. of Environment Systems Engineering.
For primary bibliographic entry see Field 5B.
W78-02481

CHEMICAL AND MINERALOGICAL COMPOSITION OF THE SEDIMENTS OF LAKES WITH LOW BIOLOGICAL PRODUCTIVITY, (IN ESTONIAN),
Akademiya Nauk Estonskoi SSR, Tartu. Inst. of Zoology and Botany.
For primary bibliographic entry see Field 5A.
W78-02504

NUTRIENTS IN ESTUARIES,
Marine Biological Lab., Woods Hole, MA. Ecosystems Center.
For primary bibliographic entry see Field 5B.
W78-02508

INSECTICIDE RESIDUES ON STREAM SEDIMENTS IN ONTARIO, CANADA,
Department of Agriculture, London (Ontario). Research Inst.
For primary bibliographic entry see Field 5A.
W78-02513

TIDAL PRISM OF EQUILIBRIUM INLETS,
Toups and Loiederman, Rockville, MD.
For primary bibliographic entry see Field 8B.
W78-02601

SHOALING RATES AND RELATED DATA FROM KNIK ARM NEAR ANCHORAGE, ALASKA,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 8B.
W78-02608

COASTAL CHANGES, EASTERN LAKE MICHIGAN, 1970-73,
Western Michigan Univ., Kalamazoo.
R. A. Davis, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-033 297, Price codes: A04 in paper copy, A01 in microfiche. Army Corps of Engineers, Coastal Engineering Research Center, Ft. Belvoir, VA. Technical Paper No. 76-16, October 1976. 12 fig, 8 tab, 37 ref.

Descriptors: *Beach erosion, *Lake Michigan, *Coasts, Beaches, Lake shores, Lakes, Erosion, Coastal engineering, Graphical analysis, Profiles, Beach morphology, Beach sediments, Beach profile changes, Lake levels, Bluff erosion.

This study concerned erosion of the bluff or edge of the terrace marking the landward boundary of the beach at 17 sites along a 250-mile segment of the east coast of Lake Michigan. Data were collected every 4 weeks for 3 years beginning in August 1970, during a period when mean monthly lake levels in Lake Michigan rose about 1.5 feet to record levels in the spring and summer of 1973. Bluff or terrace erosion was intermittent during the first 2 years, but universal during the final year, suggesting a critical lake level of about 580.0 feet, International Great Lakes datum (IGLD), above which erosion on this coast generally occurs everywhere. For the 3-year period, net bluff erosion varied from 1 cubic yard per foot of beach front at two sites, one in the north and one in the south of the study area, to a maximum loss of 39 cubic yards per foot at the site on Big Sable Point. Erosion within the study area was intermittent over time periods equal to the survey interval (4 weeks), and local compared to distances between sites (about 15 miles). Erosion increased with increase in lake level, although it is evident that lake level is merely a passive factor that permits waves to attack closer to the shore. Most erosion occurred during the late fall storm season when mean monthly lake levels were actually declining. Local factors, including bluff composition, shoreline orientation, occurrence of longshore bars, and protection from shore ice, appear to be important in determining erosion rates. Most of the sites in this study were away from the influence of coastal engineering structures. An aerial photo study of these sites from 1938 to 1972 showed that long-term erosion is closely tied to lake level, and that sand terraces form rapidly in the backshore during periods of low water. Beach sediments appear to be locally derived, and sand size does not show a clear relationship to the slope of the beach face. (Lee-ISWS)
W78-02609

SHORELINE SURVEY: GREAT PECONIC, LITTLE PECONIC, GARDINERS, AND NAPEAGUE BAYS,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 2L.
W78-02648

SHORELINE AND BATHYMETRIC CHANGES IN AND AROUND UPPER SANDUSKY BAY SINCE 1905,
Ohio Dept. of Natural Resources, Sandusky. Div. of Geological Survey.
For primary bibliographic entry see Field 5C.
W78-02651

2K. Chemical Processes

GEOCHEMICAL INVESTIGATIONS OF ICE SHEETS IN MIZUHO PLATEAU AND WEST ENDERBY LAND,
Muroran Inst. of Technology, Hokkaido (Japan).
For primary bibliographic entry see Field 2C.
W78-02239

METHANE PRODUCTION IN THE WATERS OFF WALVIS BAY,
Woods Hole Oceanographic Institution, MA. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W78-02261

METHODS FOR DETERMINATION OF RADIOACTIVE SUBSTANCES IN WATER AND FLUVIAL SEDIMENTS,
Geological Survey, Lakewood, CO. Water Resources Div.; and Colorado School of Mines, Golden.
For primary bibliographic entry see Field 5A.
W78-02429

METHODS FOR COLLECTION AND ANALYSIS OF AQUATIC BIOLOGICAL AND MICROBIOLOGICAL SAMPLES,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 5A.
W78-02432

DETERMINATION OF ORGANIC MATTER IN WATER: A REVIEW, (IN SWEDISH),
National Swedish Environment Protection Board, Stockholm. Undersokhningslab.
For primary bibliographic entry see Field 5A.
W78-02526

INVESTIGATIONS OF THE DUNES GEOTHERMAL ANOMALY, IMPERIAL VALLEY,

CALIFORNIA: PART 1, GEOCHEMISTRY OF GEOTHERMAL FLUIDS,
California Univ., Riverside. Inst. of Geophysics and Planetary Physics.
For primary bibliographic entry see Field 2F.
W78-02535

MIGRATION OF INSOLUBLE AND SOLUBLE IMPURITIES IN TEMPERATE ICE: STUDY OF A VERTICAL ICE PROFILE THROUGH THE GLACIER DU MONT DE LANS (FRENCH ALPS),
Grenoble-1 Univ. (France). Inst. de Geographie Alpine.
For primary bibliographic entry see Field 2C.
W78-02582

TECHNIQUE FOR STUDYING STRUCTURE OF SEA ICE,
National Research Council of Canada, Ottawa (Ontario), Div. of Building Research.
For primary bibliographic entry see Field 2C.
W78-02589

COMPRESSIBILITY OF DISTILLED WATER AND SEAWATER,
Woods Hole Oceanographic Institution, MA.
A. Bradshaw, and K. Schleicher.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A031 374, Price codes: A02 in paper copy, A01 in microfiche. Report No. WHOI-76-89, October 1976. 12 p, 4 fig, 3 tab, 27 ref. N00014-66-C-0241.

Descriptors: *Compressibility, *Water properties, *Salinity, *Sea water, *Physical properties, Volume, Equations, Water temperature, Water pressure, Properties, Saline water, Density, Pressure, Temperature, *Distilled water properties, *Sea water properties, Distilled water, Thermal expansion coefficient.

The compressions of distilled water and of seawater of approximately 31, 35, and 39 parts/thousand, salinity were measured at 10C for pressures up to 1000 bars. The data were summarized by a 'best' least-square fit polynomial in pressure and salinity. The summary formula was combined with Bryden's similar type fit to earlier thermal expansion data and Fofonoff and Bryden's recent empirical formula for sigma-0 of seawater to give an expression for the specific volume of seawater as a function of temperature, pressure, and salinity in the salinity range 31 to 39 parts/thousand. At 35 parts/thousand, specific volumes from this expression in the oceanographic range of temperature and pressure agree within 0.000015 cu cm/g with those computed using sound velocities. Mean compressibilities for distilled water at 10C also agree with those from sound velocities (to within 0.05%) but disagree with those of Kell and Whalley by about 0.3%. (Henley-ISWS)
W78-02613

ELECTRICAL DETECTION PROBLEMS IN WATER ANALYSIS BY SPARK SOURCE MASS SPECTROMETRY,
Virginia Univ., Charlottesville. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W78-02674

2L. Estuaries

EFFICIENCY IMPACTS OF COST SHARING ON SHORELINE MANAGEMENT,
National Bureau of Standards, Washington, DC.
For primary bibliographic entry see Field 6C.
W78-02208

DIVIDING OCEAN RESOURCES: A DEVELOPMENT AND APPLICATION OF THE THEORY OF FACTOR TRANSFER,
University of Western Ontario, London.
For primary bibliographic entry see Field 6C.
W78-02212

PORT IMPROVEMENT DESIGN CRITERIA FOR TEXAS COAST,
Texas A and M Univ., College Station. Ocean Engineering Program.
For primary bibliographic entry see Field 8B.
W78-02245

BEACH EROSION DURING MINOR STORM,
South Carolina Univ., Columbia. Dept. of Geology.
T. W. Kana.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 103, No. WW4, Proceedings Paper 13335, p 505-518, November 1977. 8 fig, 4 tab, 30 ref, 1 append. Army DACW72-74-C-0018.

Descriptors: *Beach erosion, *Beaches, *Storms, *South Carolina, Winds, Waves(Water), Tides, Ocean waves, Berms, Islands, Erosion, Geomorphology, Sands, Seashores, Coasts, Surveys, Data processing, *Debidue Island(SC).

Over 12 cu m of sand per meter of beach was eroded at Debidue Island, South Carolina, during a minor northeast storm on September 23, 1974. Process measurements and beach surveys made before, during, and after the storm isolated the period of maximum erosion and suggested the threshold process values at the initiation of erosion. Storm processes on the 23rd included winds of 9.1 m/s from the northeast, 6.5 sec breakers 100 cm to 120 cm high, and average wave steepness (H sub o/L sub o) equal to 0.012. The beach was 50% steeper than normal and contained well-developed cusps before the erosion, facilitating formation of a berm scarp. The bulk of erosion resulted from the undermining and slumping of the scarp at high tide. Threshold process values for Debidue Island at the onset of erosion (for tan Beta = 0.055) were estimated to include: wind velocity 7 to 9 m/s; wave height greater than 100 cm; wave period less than 7.0 sec. These process values are exceeded up to 14% of the time, but significant erosion will only occur a few days each year due to influence of beach slope, beach morphology, and water level on the erosional efficiency of waves. (Sims-ISWS)
W78-02246

STORM TIDE FREQUENCIES FOR CAPE FEAR RIVER,
National Weather Service, Silver Spring, MD. Office of Hydrology.
For primary bibliographic entry see Field 8B.
W78-02247

OBSERVATIONS OF SHEAR IN NEAR-BED CURRENTS IN THE SOUTHERN NORTH SEA,
University of East Anglia, Norwich (England). School of Environmental Sciences.
For primary bibliographic entry see Field 8B.
W78-02256

MULTICHANNEL SEISMIC REFLECTION PROFILES OF THE CONTINENTAL CRUST BENEATH THE NEWFOUNDLAND RIDGE,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia).
A. C. Grant.
Nature, Vol. 270, No. 5632, p 22-25, November 3, 1977. 3 fig, 11 ref.

Descriptors: *Remote sensing, *Sediments, *Continental shelf, *Atlantic Ocean, Oceans, Geology, Topography, Stratification, Geomorphology, Marine geology, Oceanography, *Seismic data, *Newfoundland Ridge.

Multichannel seismic reflection profiles extending south from the Grand Banks indicated that large 'basement' features underlying the Newfoundland Ridge are composed of sedimentary strata. The Newfoundland Ridge, therefore, is interpreted as an area of subsided continental crust rather than a ridge of oceanic crust. The J magnetic anomaly intersects the complex, and the physiographic ridge associated with the anomaly also may be continental in origin. (Sims-ISWS)
W78-02260

METHANE PRODUCTION IN THE WATERS OFF WALVIS BAY,
Woods Hole Oceanographic Institution, MA. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W78-02261

OCCURRENCE AND DISTRIBUTION OF BACTERIAL INDICATORS AND PATHOGENS IN CANAL COMMUNITIES ALONG THE TEXAS COAST,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
For primary bibliographic entry see Field 5B.
W78-02391

AGAT SEWAGE TREATMENT PLANT: IMPACT OF SECONDARY TREATED EFFLUENT ON GUAM COASTAL WATERS,
Guam Univ., Agana. Water Resources Research Center.
For primary bibliographic entry see Field 5C.
W78-02398

FACTORS AFFECTING THE AVAILABILITY OF SEDIMENT-BOUND CADMIUM TO THE ESTUARINE, DEPOSIT-FEEDING CLAM, MACOMA BALTHICA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 5C.
W78-02427

SALINE-WATER INTRUSION RELATED TO WELL CONSTRUCTION IN LEE COUNTY, FLORIDA,
For primary bibliographic entry see Field 5B.
W78-02434

INTERNALIZATION IN A STOCHASTIC POLLUTION MODEL,
Tel-Aviv Univ., (Israel). Dept. of Economics.
For primary bibliographic entry see Field 5G.
W78-02440

USE OF ECOLOGICAL PROFILES IN THE STUDY ON THE DYNAMICS OF COASTAL LANDSCAPES, (IN RUSSIAN),
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
N. P. Nazarova.
Ekologiya 6(6), p 84-86, 1975.

Descriptors: *Salt marshes, Ecology, Aeluropus litoralis, Atropis distans, Bolboschoennus maritimus, Coastal waters, *Ecological distribution, Eleocharis palustris, Glycyrrhiza glabra, Halocnemum strobilacium, *Landscapes(Coastal), Phragmites communis, Recreation, Salicornia herbacea, Scirpus lacustris, Suaeda prostrata, USSR, Potable water.

Distribution of 5 plant communities in salt marshes on the Belosaraskaya and Berdyanskaya spits along the northern shore of the Sea of Azov (USSR) was studied in relation to changes in hydrogeological and geomorphological conditions. The dominant species, from the sea to the depth of

the spits, were Phragmites communis, Bolboschoenus maritimus, Scirpus lacustris, Eleocharis palustris; Salicornia herbacea, Suaeda prostrata; Salicornia herbacea, Halocnemum strobilaceum; Atropis distans, Aeluropus litoralis, Glycyrrhiza glabra; and Scirpus and Halocnumum, respectively. The observed sand thrust and soil burial are favorable from a recreational point of view, since they expand the area of eolian sands. Technical support of this natural process will promote free precipitation infiltration and moisture condensation and lead to accumulation of water suitable for drinking.--Copyright 1977, Biological Abstracts, Inc.
W78-02446

SHALLOW WAVE DIFFRACTION AROUND LARGE CYLINDER,
British Columbia Univ., Vancouver. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W78-02447

QUANTITATIVE STUDIES OF FAUNAL LIMITS IN THE NORTH ADRIATIC PHYTAL, USING POLYCHAETES AS AN EXAMPLE, (IN GERMAN),
Vienna Univ. (Austria). Zoologisches Inst.
B. Velimirov, and P. Sint.
Sitzungsber Oesterr Akad Wiss Math-Naturwiss Kl Vol 184, Nos. 8-10, p 341-368, 1975.

Descriptors: Aquatic animals, Aquatic algae, *Adriatic Sea, *Polychaetes, Yugoslavia, Water pollution, *Cytoseira.

The characteristic alga of the sublittoral hard bottom of the Adriatic and Mediterranean belongs to the genus Cytoseira. The polychaetes, common among Cytoseira were classified. A statistical effort was made to classify these organisms by localities with weak, medium and strong wave exposure. The samples were taken in 3 places in the Adriatic near the town of Rovinj, Yugoslavia. The distribution samples of polychaetes in brown algae is the same for all locations and is little affected by wave exposure. Pollution is rapidly distributed and removed by strong waves. A large number of polychaete species are listed for each sampling and for each of the 3 locations.--Copyright 1977, Biological Abstracts, Inc.
W78-02451

THE HYDROGRAPHY OF THE MURDERKILL ESTUARY, DELAWARE,
Delaware Univ., Newark. Dept. of Biological Sciences.
P. Dewitt, and F. C. Daiber.
Chesapeake Sci. Vol. 15, No. 2, p 84-95, 1974.

Descriptors: *Delaware, Dyes, Estuaries, *Hydrography, *Murderkill Estuary(Del), Seasonal, Sewage, Tracers, Turbidity, Water temperature, Dissolved oxygen, Pollutant identification, Salinity.

Seasonal and tidal variations of salinity, water temperature, dissolved O2, pH and turbidity were measured. The Murderkill Estuary has characteristics of both a well-mixed and partially-mixed estuary. The prevailing hydrographic regime is maintained by tidal mixing and forced river flow which disrupt density-induced, internal circulation. Approximately 90% of the upstream salt flux is maintained by diffusion. During mean freshwater runoff the estuary discharges 1.7 x 10 to the 5th power m3 of freshwater seaward per tidal cycle and has a flushing time of 4.4 tidal cycles. The flushing time decreases from 18.4 tidal cycles during low runoff, 3.1 x 10 to the 4th power m3/tidal cycle, to 2.6 tidal cycles during high runoff, 3.1 x 10 to the 5th power m3/tidal cycle. The proposed daily discharge of 3.8 x 10 to the 4th power m3 of sewage effluent into the estuary will shorten the flushing time of the estuary at the discharge site from 4.4 to 3.9 tidal cycles during mean runoff. Salinity distributions in the estuary are highly variable. At high water, the lower reaches of the estuary are occupied by moderately saline water, 15.7-28.2%, from lower Delaware Bay. Vertical and longitudinal salinity gradients are small. In the central section of the estuary, salinity decreases from values characteristic of lower Delaware Bay to 1.0%. Mean vertical salinity differences are 2.0% and the mean longitudinal salinity gradient is 2.7% km. In tidal freshwater, salinity does not exceed 1.0% and salinity gradients, verical and longitudinal, are small. At low water, salinity in the lower reaches of the estuary is reduced substantially. The water column is well mixed and the mean longitudinal salinity gradient is 2.4%/km. Tidal freshwater occupies the upstream 30-70% of the estuary with increasing runoff. Dissolved O2 concentrations in the estuary range from 10-12 mg/l during the witer to 2 to 3 mg/l during the summer. A zone of O2 depletion appears in the central section of the estuary. This section will receive the effluent from the sewage-treatment facility. Oxygenated water presently enters the central section of the estuary from inland freshwater runoff and from lower Delaware Bay.--Copyright 1974, Biological Abstracts, Inc.
W78-02459

VEGETATION TYPES IN AN IRREGULARLY FLOODED SALT MARSH ON THE NORTH CAROLINA OUTER BANKS,
North Carolina State Univ. at Raleigh. Dept. of Botany.
A. W. Coopr, and E. D. Waits.
J Elisha Mitchell Sci Soc. 89(1/2), p 78-91, 1973.

Descriptors: *Vegetation, *Salt marshes, *Environmental gradient, *Speciation, Coastal marshes, Salinity, Sands, Peat, Distribution patterns, Wetlands, Water level fluctuations, Ecotypes, *North Carolina, Juncus roemerianus, Outer Banks, Spartina patens.

Vegetation types and environmental factors were studied in an irregularly flooded salt marsh on southern Bodie Island on the North Carolina Outer Banks. Vegetation data were obtained from a restricted random sample of 0.1 m2 plots. Depth of peat, texture of underlying sand, elevation of the surface, and water depth and salinity were also measured. Analysis of species associations indicated that 5 well-defined groups of species were present. These were grouped into 6 vegetation types, each associated with a distinct set of environmental factors. A Spartina patens type covered 32% of the area, generally between the ponds in the center of the marsh and the margin. Wetter areas in this zone and around the central ponds were occupied by a Mixed type, dominated by the species of the S. patens type, but in different proportions. Several annuals were important in this type during the early part of the study. A large, pure stand of Juncus roemerianus occurred around the head of the creek draining the marsh. Several ponds, one high in salinity and the rest low, occupied the center of the area. A Marginal type occurred around the edge of the marsh where it graded into the upland. Areas of sand spoil were dominated by an open sand type. The substratum under the marsh was a uniform fine sand. Peat was deepest under the Juncus type and became shallower toward the marsh margin. The ponds had the lowest elevation (1.39 ft.), followed by the Juncus (1.61 ft.), S. patens and Mixed (1.94 and 2.01 ft.), and Marginal types (2.08 ft.). The elevational pattern of species distribution agreed with similar data from studies of regularly flooded marshes and with the elevation pattern of the vegetation types. Water levels and salinities varied according to patterns of rainfall, tides and evaporation rates. Vegetation types in the study area resemble those described for Currituck Sound and Black Bay, Virginia, slightly to the north of the study area.--Copyright 1974, Biological Abstracts, Inc.
W78-02461

EFFECT OF SOME POLLUTANTS ON THE FILTRATION RATE OF MYTILUS,
Newcastle-upon-Tyne Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5C.
W78-02471

THE FATE OF STORM WATER AND STORM-WATER POLLUTION IN THE PARRAMATTA ESTUARY, SYDNEY,
Snowy Mountains Engineering Corp., Cooma (Australia).
For primary bibliographic entry see Field 5B.
W78-02473

EFFECTS OF ATHENS POLLUTION OUTFALLS ON MARINE FAUNA OF THE SARONIKOS GULF,
Durham Univ. (England). Dept. of Botany.
For primary bibliographic entry see Field 5C.
W78-02479

RATES OF REMINERALIZATION AND ASSIMILATION OF UREA BY FRACTIONATED PLANKTON POPULATIONS IN COASTAL WATERS,
Queen's Univ., Belfast (Northern Ireland). Marine Biology Station.
For primary bibliographic entry see Field 5C.
W78-02484

TEMPORAL CHANGES IN PELAGIC BIOMASS OF PLEURONCODES PLANIPES STIMPSON (DECAPODA ANOMURA, GALATHEIDAE) OFF BAJA CALIFORNIA, MEXICO,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
For primary bibliographic entry see Field 5C.
W78-02485

GROWTH OF AN ESTUARINE PSEUDOMONAS SP. ON POLYCHLORINATED BIPHENYL,
Maryland Univ., College Park, Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W78-02487

A CYTOCHEMICAL AND BIOCHEMICAL INDEX OF STRESS IN MYTILUS EDULIS L.,
Institute for Marine Environmental Research, Plymouth (England).
For primary bibliographic entry see Field 5C.
W78-02489

LEAD IN PORT PHILLIP BAY MUSSELS,
La Trobe Univ., Bundoora (Australia). Dept. of Inorganic and Analytical Chemistry.
For primary bibliographic entry see Field 5A.
W78-02490

KEPONE BIOCONCENTRATION, ACCUMULATION, LOSS AND TRANSFER THROUGH ESTUARINE FOOD CHAINS,
Environmental Research Lab., Gulf Breeze, FL.
For primary bibliographic entry see Field 5C.
W78-02502

ENVIRONMENTAL REGULATION OF PHYTOPLANKTON PRODUCTIVITY IN THE LOWER HUDSON ESTUARY,
City Univ. of New York. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W78-02505

NUTRIENTS IN ESTUARIES,
Marine Biological Lab., Woods Hole, MA. Ecosystems Center.
For primary bibliographic entry see Field 5B.
W78-02508

POLLUTION HISTORY OF ESTUARINE SEDIMENTS,
Scripps Institution of Oceanography, La Jolla, CA.
For primary bibliographic entry see Field 5B.
W78-02509

THE INFLUENCE OF ORGANIC MATTER AND ATMOSPHERIC DEPOSITION ON THE PARTICULATE TRACE METAL CONCENTRATION OF NORTHWEST ATLANTIC SURFACE SEAWATER,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 5B.
W78-02512

THE SEASONAL DISTRIBUTION OR ORGANIC CARBON IN A LOUISIANA ESTUARY,
Louisiana State Univ., Baton Rouge. Dept. of Marine Sciences.
For primary bibliographic entry see Field 5B.
W78-02593

INTERSTITIAL SALINITY AS A CAUSE OF ECOPHENIC VARIATION IN SPARTINA ALTERNIFLORA,
Georgia Univ., Athens. Inst. of Ecology.
J. Nestler.
Estuarine and Coastal Marine Science, Vol 5, No 6, p 707-714, November 1977. 3 fig, 28 ref. NFS DES72-01605-A02.

Descriptors: *Salt marshes, *Vegetation, *Salt tolerance, *Grasses, Salinity, Saline water intrusion, Saline water, Connate water, Nutrients, Plant growth, Plant growth regulators, Soils, Soil water, Coasts, Marshes, Marsh plants, Coastal marshes, Drainage, Tidal effects, On-site investigations, Biology, Salt marsh grasses.

This work supported the postulate that the height of Spartina alterniflora plants on salt marshes is a function of the total dissolved salt concentration of the underlying substrate. This hypothesis was tested by a combination of observations and perturbations. These activities led to the conclusion that the horizontal stability of the interstitial water allows the formation of interstitial salinity clines on the salt marsh. Pore water salinities are lowest near sources of estuarine or freshwater, and highest in areas further removed (elevationally) from sources of low saline water. The growth of Spartina alterniflora is inversely related to the interstitial salinity along these clines. Growth is robust in low saline areas and weak in areas of high pore water salinity. A case for a causal relationship between interstitial salinity and Spartina growth forms was presented. (Sims-ISWS)
W78-02594

INVESTIGATIONS ON DISSOLVED URANIUM, SILICON AND ON PARTICULATE TRACE ELEMENTS IN ESTUARIES,
Physical Research Lab., Ahmedabad (India).
For primary bibliographic entry see Field 5A.
W78-02595

HEAT BALANCE IN A SMALL COASTAL INLET PAUATAHANUI INLET, NORTH ISLAND, NEW ZEALAND,
Department of Scientific and Industrial Research, Wellington (New Zealand). Oceanographic Inst.
R. A. Heath.
Estuarine and Coastal Marine Science, Vol 5, No 6, p 783-792, November 1977. 6 fig, 1 tab, 7 ref.

Descriptors: *Heat balance, *Heat budget, *Estuaries, Inlets(Waterways), Solar radiation, Evaporation, Advection, Heat transfer, Tides, Mud flats, Coasts, Thermal conductivity, On-site data collections, Foreign countries, Foreign research, *New Zealand, Long-wave radiation, Sensible heat.

Examination of the heat budget in Pauatahanui Inlet, a small (3.5 sq km) New Zealand, coastal inlet, indicates that the balance is between solar and long wave radiation, evaporation, and advective heat exchange with the coastal waters. The role of the mudflat in the heat balance is only minor. The temperature at the entrance to the inlet exhibits strong tidal fluctuations resulting from exchange with the coastal waters and a diurnal inequality produced by interaction simulated temperature record for a month, calculated from a heat budget equation with 24 h and 12 h sinusoidal heat transfers approximating those observed on 16 March 1976, exhibits the effect of the tidal/solar interaction in producing a 14.75 day beat, variable diurnal inequality, and the generation of many high frequency components. (Visocky-ISWS)
W78-02596

WAVES GENERATED BY HORIZONTAL OSCILLATIONS IN BAYS,
Tetra Tech, Inc., Pasadena, CA. Engineering Div.
For primary bibliographic entry see Field 8B.
W78-02600

TIDAL PRISM OF EQUILIBRIUM INLETS,
Toups and Loiederman, Rockville, MD.
For primary bibliographic entry see Field 8B.
W78-02601

SHOALING RATES AND RELATED DATA FROM KNIK ARM NEAR ANCHORAGE, ALASKA,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 8B.
W78-02608

SHORELINE SURVEY: GREAT PECONIC, LITTLE PECONIC, GARDINERS, AND NAPEAGUE BAYS,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
M. T. Eisol.
Special Report No. 5, Reference 77-1, May 1977. 43 p, 23 fig, 9 tab, 33 ref.

Descriptors: *Beach erosion, *Waves(Water), *Tidal effects, *Baseline studies, Ocean waves, Storms, *New York, *Bays, Shoreline configuration, Land loss.

The beaches and bluffs along Great Peconic, Little Peconic, Gardiners and Hapeague Bays have attained their present form through a long erosional history. Changes in shoreline configuration have been determined by comparing nautical charts from the mid-1800's with those of today. This comparison has shown significant land loss especially for those areas east of Shelter Island. These areas, unprotected by a land mass in the path of wind and waves, receive the full impact of those erosional forces. A field survey of the shore area within the eastern forks of Long Island was completed in the fall of 1973. Particular attention was given to the natural earth processes (slides, subsidence and rain run-off) and their effect on shoreline characteristics as well as the influence of storms, wind and waves. Information pertaining to storms, ownership and population statistics have been updated through 1976. (NOAA)
W78-02648

MERCURY CONTENT OF MUSSELS FROM ST. LAWRENCE ESTUARY AND NORTHWESTERN GULF OF ST. LAWRENCE, CANADA,
For primary bibliographic entry see Field 5A.
W78-02671

RESIDUAL 2,4-D LEVELS IN THE ST. JOHNS RIVER, FLORIDA,
Army Engineer District, Jacksonville, FL.
For primary bibliographic entry see Field 5A.
W78-02679

RELATIONSHIP OF SCARLET PRAWNS (PLESIOPENAEUS EDWARDSIANUS) TO A BENTHIC OIL DEPOSIT OFF THE NORTHWEST COAST OF ARUBA, DUTCH WEST INDIES,
National Marine Fisheries Service, Miami, FL. Southeast Fisheries Center.
For primary bibliographic entry see Field 5C.
W78-02699

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

GEOTHERMAL ENERGY RECOVERY PROCESS,
Bechtel Corp., San Francisco, CA.
L. Awerbuch, T. E. Lindemuth, S. C. May, and A. N. Rogers.
Desalination, Vol. 19, p 325-336, December, 1976. 4 fig, 1 tab, 2 ref.

Descriptors: *Thermal power, *Brines, *Desalination, Turbines, Corrosion, Thermal water, Distillation, *Geothermal studies, *Steam flashing systems.

A process for harnessing energy from geothermal brines is presented that is attractive in that it is potentially applicable to the production of both power and water. Corrosion and deposition of solids on power plant components have posed some difficult engineering problems for designers wishing to utilize thermal brines by the steam flashing method. A variant of this method is described by which components are isolated from corrosive soluble gases and scale-forming vapors by exposing them only to pure steam (generated by transferring heat from flashed geothermal vapor to distilled water). Multiple staging of both brine and turbine exhaust contributes to the thermal efficiency of this particular method. Cost analysis indicates that the process should be as economical as fossil-fuel production of electricity at present rates, and more so as the prices of fossil fuels rise. The value of water produced by the process would offset the power production costs as well. (Eberle-NWWA)
W78-02277

DESALTING GEOTHERMAL BRINES,
California Univ., Berkeley. Sea Water Conversion Lab.
A. D. K. Laird, and B. W. Tleimat.
Desalination, Vol. 19, p 309-316, December, 1976. 5 fig, 3 ref.

Descriptors: *Desalination, *Thermal power, *Brines, *Distillation, Steam, Thermal waters, Thermodynamics, Economics, Turbines, Flash distillation, *Geothermal brines, Geothermal studies.

Excellent opportunities exist to produce fresh water by desalination of geothermal brines heated by hot rock (found near volcanic instrusions in many parts of the earth's crust). Geothermal desalination methods are described how the differences between them and conventional desalination methods can be accommodated in process design is illustrated. Because geothermal feedwater is supplied hot, familiar desalination plant components can be used effectively but, generally, in different arrangements. Examples of multieffect distillation and multistage-flash distillation processes are presented schematically. The production of power and water that can be expected from a wide range of possible plant con-

figurations can be rapidly determined from three simple calculation diagrams given. Changes in thermodynamic conditions during desalting and power production processes can be read directly from these diagrams. (Eberle-NWWA)
W78-02293

OPTIMAL CAPACITY EXPANSION WITH OFF-DESIGN COSTS,
California Univ., Berkeley. Dept. of Civil Engineering.
C. R. Scherer, and R. Chiulli.
Journal of the Water Resources Planning and Management Division, Vol 103, No WR2, Proceedings of the American Society of Civil Engineers, Proceedings paper No 13327, p 213-226, November 1977. 5 fig, 4 tab, 18 ref.

Descriptors: *Desalination, *Optimization, *Operating costs, *Maintenance costs, *Salinity, *Desalination plants, Design, Water quality control, Planning, *Water treatment, Reverse osmosis, Brackish water, Equations, Mathematical models, Systems analysis, *Capacity reduction, *Mixed-integer programming, Economic analysis, Cost minimization.

The effect of 'off-design' operating costs on operating and capacity expansion policy is considered for the planning of a water treatment facility. A mixed-integer programming model is presented for minimizing discounted costs of dynamically expanding a reverse-osmosis process that is required to remove increasing levels of salt over time from a brackish stream. Several possible product effluent qualities are consisted as variables in the model. Results show the explicit consideration of off-design operating costs can influence capacity expansion planning and reduce actual system costs by a small percentage for desalting facilities. This (apparently small) percentage saving could amount to significant absolute savings in multimillion dollar projects. Analogous percentage savings in other process planning (e.g., municipal water and wastewater treatment, and power generation) could be more or less significant depending on the relationship of design to off-design generating costs. (Bell-Cornell)
W78-02450

CONCEPTUAL DESIGN OF COMMERCIAL 50 MWE (NET) GEOTHERMAL POWER PLANTS AT HEBER AND NILAND, CALIFORNIA.
Bechtel International Corp., San Francisco, CA.
For primary bibliographic entry see Field 8C.
W78-02550

3B. Water Yield Improvement

EVALUATION OF MILES CITY SWR-75 WEATHER RADAR,
South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
For primary bibliographic entry see Field 7A.
W78-02227

DEVELOPMENT OF AN EXPERIMENTAL HYDROMETEOROLOGICAL DATA COLLECTION NETWORK,
Western Scientific Services, Inc., Fort Collins, CO.
For primary bibliographic entry see Field 2B.
W78-02228

TRACER AND DIFFUSION AND CLOUD MICROPHYSICAL STUDIES IN THE AMERICAN RIVER BASIN,
Washington Univ., Seattle. Dept. of Atmospheric Sciences.
A. L. Rangno, P. V. Hobbs, and L. F. Radke.
Final Report No 1, August 1977. 245 p. Submitted to Bureau of Reclamation, Denver, Colo., Div. of Atmospheric Water Resources Mgmt. Bur Reclam 6-07-DR-20140.

Descriptors: *American River Basin(Calif), California, *Tracers, Airflow, *Diffusion studies, *Cloud physics, *Weather modification, *Cloud seeding, Cloud modification, Sierra Project(Bur Reclam).

An airborne field study was conducted over the American River Basin (ARB) of the Sierra Nevadas to: (1) determine the transport and diffusion of materials released from the ground and the air during various types of storm situations; (2) compare the observed plumes with those predicted by stratified tank model simulations; (3) obtain cloud microphysical measurements; (4) obtain airborne precipitation particle measurements in support of an auxilliary study comparing radar reflectivities and precipitation rates on the ground; and (5) search for extraneous ice nucleus sources which could affect the Basin. Results showed: (1) negligible vertical dispersion for ground and airborne releases in a dry environment with a lapse rate equal to or less than pseudo-adiabatic; (2) adequate vertical dispersion, sufficient to result in cloud ingestion and precipitation fallout in the ARB, in post-frontal air masses characterized by steep (greater than pseudo-adiabatic) lapse rates, gusty surface winds with a westerly component, and an abundance of orographic cumulus and scattered small cumulonimbus; (3) stratified tank model simulations strongly resemble the observed plumes; (4) no viable relationship between measured ice particle concentrations and cloud top temperatures. The disrupting factor was that while cold (< -25C) clouds contained high (> 40 1/l) ice particle concentrations, warmer clouds (> or equal to -20C) exhibited both high (> 40 1/l) and comparatively low (< 3 1/l) ice particle concentrations; (5) a strong growth zone for post-frontal cumulus clouds between 30 and 65 km upwind of the Sierra Crest. This zone was usually characterized by high liquid water contents, more vigorous cumulus growth than elsewhere, and variable ice particle concentrations. This growth zone may be the best target for ice nuclei released for the purpose of increasing precipitation in the American River Basin. (Bur Reclam)
W78-02229

ATMOSPHERIC SIMULATION USING STRATIFIED LIQUID MODELS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
H. T. Falvey, and R. A. Dodge.
Report No REC-ERC-77-8, July 1977. 96 p, 51 fig, 1 tab, 12 ref, 3 append.

Descriptors: *Atmospheric research, *Model studies, *Field investigations, *Weather modification, Cloud seeding, Similitude, Simulation analysis, Project Skywater, Leadville-Climax Pilot Project, Sierra Cooperative Pilot Project, Colorado River Basin Pilot Project.

Analytical and laboratory studies were made to demonstrate the feasibility of using stratified liquids and distorted scale maps of an area to simulate mesoscale (2 to 20 kilometres) atmospheric phenomena. Techniques and instrumentation were developed for creating velocity gradients and density gradients, for visualization, and for making measurements. The effectiveness of both aerial and ground seeding station locations was investigated for various pilot study areas of Project Skywater. (Bur Reclam)
W78-02267

AN OVERVIEW OF THE SKYWATER IX CONFERENCE ON PRECIPITATION MANAGEMENT AND THE ENVIRONMENT, DISCUSSION AND SUMMARY REPORTS.
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
Conference held in Vail, Colorado, in second week of November 1976. Report published September 1977. 223 p, 10 fig, 14 ref, 6 append.

Descriptors: *Weather modification, *Management, *Precipitation enhancement, *Cloud seeding, Environmental effects, Ecology, Ecosystems, Water resources management, Cloud seeding potential, *Conferences, Great Plains, High Plains, Rocky Mountains, Sierra Nevada, Great Basin, Western United States.

Called to assess results and solicit contributions for future planning in the Bureau of Reclamation's weather modification research, the Skywater IX Conference held six workshops, each assembled by an appointed convener. Abiotic processes were found best understood as to water yield and least so as to erosion and fluvial geomorphology. Alpine settings are most sensitive. Erosion and mass wasting are leading issues for summer programs, and snow duration for winter programs. Effects on vegetation in the High Plains are seen to come mostly from possible changes in land use and cultivation stemming from rain stimulation. In alpine areas, snow duration, especially in areas of drifting, would be the most important factor. Animal species selected as impact receptors include pronghorns affected by possible encouragement of encroaching civilization, and elk and mule deer affected by possible influence on range conditions, especially winter range. Anticipated societal benefits of more crops and clean power face barriers in the lack of adequate determination of ownership and pricing of water developed by precipitation augmentation, and the lack of appropriate institutions for carrying it on. Seeding agents are thought to have no significant effects. An environmental overview noted concern for possible initiation of long-term trends, linkage with conservation activities, and information transfer in the context of a regional concept. Implications for planning of Skywater environmental studies are discussed. (Bur Reclam)
W78-02272

THE ARIZONA WATER RESOURCES COMMITTEE: HISTORY AND POLITICS,
Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 6E.
W78-02400

SUMMARY REPORT, GENERALIZED CRITERIA FOR SEEDING WINTER OROGRAPHIC CLOUDS.
Bureau of Reclamation, Denver, CO. Div. of Atmospheric Water Resources Management.
Skywater Monograph No. 1, March 1977. 12 p, 5 fig.

Descriptors: *Cloud seeding, *Orographic clouds, *Weather modification, Precipitation augmentation, Cloud seeding criteria, Snow, Cloud physics, Snowpack augmentation, Winter orographic clouds, *Rocky Mountain Region, *Pacific Coast Region.

The Bureau of Reclamation is carrying out an analysis of data from past weather modification projects to identify criteria that define conditions when cloud seeding will increase winter snowfall in mountainous terrain and when it will have no effect or decrease precipitation. The study is seeking generalized seedability criteria based on physically meaningful and easily measurable variables. Seven projects that operated during the 1960's and 70's in the Rocky Mountains, the Sierra Nevada, and California's southern Coast Range are being used in this study, representing a wide range of meteorological and topographic conditions. (See also W78-02408)
W78-02407

GENERALIZED CRITERIA FOR SEEDING WINTER OROGRAPHIC CLOUDS,
Bureau of Reclamation, Denver, CO. Div. of Atmospheric Water Resources Management.
L. Vardiman, and J. A. Moore.
Skywater Monograph No. 1, July 1977. 119 p, 30 fig, 8 tab, 6 ref, 2 append.

Descriptors: *Cloud seeding, *Orographic clouds, *Weather modification, Precipitation augmentation, Cloud seeding criteria, Snow, Cloud physics, Snowpack augmentation, Winter orographic clouds, *Rocky Mountain Region, *Pacific Coast Region.

An a posteriori analysis is being conducted utilizing precipitation, rawinsonde, and seeding generator data from seven randomized winter cloud-seeding research projects conducted in orographic settings in the Rocky Mountain West and on the Pacific Coast of the United States. Variables are being developed and investigated to establish generalized seedability criteria that are applicable under a variety of meteorological and topographic conditions. The variables are divided into four general categoreis: time available, water available, nuclei available, and mixing available. The analysis approach is to establish 'windows' under which positive (increases) or negative (decreases) seeding effects would be obtained. Thus far, the analysis shows that positive seeding effects occur at the crest under stable or unstable conditions when a 'crest trajectory' is present, moderate-to-high cloud moisture is present, and the cloud top temperature is between minus 10 and minus 30C. Decreases occur at the crest for unstable clouds with a 'blow-over' trajectory, with low cloud moisture and cloud top temperature colder than minus 30C. The precipitation for upwind and downwind regions of a barrier can also be increased or decreased depending on stability, trajectory, cloud moisture, and cloud top temperature. Other windows are discussed. (See also W78-02407)
W78-02408

WATER CONSERVATION IN CALIFORNIA.
California State Resources Agency, Sacramento. Dept. of Water Resources.
Bulletin No. 198, May 1976. (Reprinted March 1977.) 95 p, 18 fig, 29 tab, 18 ref, 2 append.

Descriptors: *Water conservation, *California(Drought), *Water utilization, Agricultural water, Municipal water, Industrial water, Planning, Rationing(Water), Management, *Alternative water use.

Approaches are presented to the current meaning of water conservation - methods that will help save water and energy and reduce waste. This bulletin describes current water use practices and possible methods of water savings and identifies where they might be most effectively used. It reviews water conservation programs already established in some parts of California and the United States. This bulletin also makes specific recommendations for immediate action. In addition a more detailed statewide water conservation program is being formulated.
W78-02409

THE CALIFORNIA DROUGHT - 1976.
California State Resources Agency, Sacramento. Dept. of Water Resources.
May 1976. 101 p, 10 fig, 6 tab, 3 append.

Descriptors: *California(Drought), *Droughts, *Drought tolerance, Climates, *Water conservation, *Water allocation(Policy), *Water distribution(Applied), Water policy, *Rationing(Water), Water utilization.

Information is summarized on water supply, current impacts, and expected impacts during the remainder of the year 1976. Discussed are some possible strategies which may be employed to ease 1976 impacts, as well as those which would occur in 1977, should the winter provide less than a normal supply. Of particular concern is the need to protect the Sacramento-San Joaquin Delta, through which vast quantities of water must pass and which is subject to specific protection under California law. This protection is presently being provided cooperatively by the state and federal governments. (See also W78-02411 and W78-02412)
W78-02410

THE CALIFORNIA DROUGHT - 1977, AN UPDATE.
California State Resources Agency, Sacramento. Dept. of Water Resources.
--February 15, 1977. 150 p, 18 fig, 11 tab, 9 append.

Descriptors: *California(Drought), *Droughts, *Drought tolerance, Climates, *Water conservation, *Water allocation(Policy), *Water distribution(Applied), Water policy, *Rationing(Water), Water utilization.

This report, prepared by the State Drought Information Center, in cooperation with federal, state, and local agencies, summarizes the impact of the drought in 1976 and brings up-to-date the status of drought conditions in 1977. (Data is current as of February 15, 1977.) Additional reports will be issued periodically as conditions change. Already significant rationing is under way in many parts of the State, and substantial deficiencies have been imposed by federal, state, and local water projects. Most hard hit are agricultural users. Many actions have been taken by the State in conjunction with federal, state, and local agencies to alleviate emergency situations. These include a transfer to Northern California of substantial quantities of Metropolitan Water District water entitlements from the State Water Project and an historic interconnection of East Bay water systems, including an arrangement to transport Metropolitan Water District exchange water to Marin County. (See also W78-02410 and W78-02412)
W78-02411

THE CONTINUING CALIFORNIA DROUGHT.
California State Resources Agency, Sacramento. Dept. of Water Resources.
August 1977. 138 p, 14 fig, 12 tab, 38 photos.

Descriptors: *California(Drought), *Droughts, *Drought tolerance, Climates, *Water conservation, *Water allocation(Policy), *Water distribution(Applied), Water policy, *Rationing(Water), Water utilization.

This is the third in a series of detailed reports on the continuing California drought, the worst in history. A great deal has been learned about individual and institutional capabilities and resources during this drought. Response to the need for better water management and reduced use has been forthcoming. Water is being used more wisely in most areas, innovative alternative sources of supply are being tried and the people are coping quite well. Economic impact is being minimized by federal and state programs of assistance. A spirit of cooperation and helpfulness has prevailed. One of the most important tasks ahead is planning for next year. There is no assurance that 1977-78 will not also be dry. Plans for the worst must be formed on an assumption that the dry conditions of 1976-77 will continue another year. If such is the case, impacts will be far more severe than these past two years. (See also W78-02410 and W78-02411)
W78-02412

FINAL REPORT-NATIONAL HAIL RESEARCH EXPERIMENT RANDOMIZED SEEDING EXPERIMENT 1972-1974, VOLUME I, EXPERIMENTAL RESULTS AND OVERALL SUMMARY,
National Center for Atmospheric Research, Boulder, CO.
E. L. Crow, P. W. Summers, A. B. Long, C. A. Knight, and G. B. Foote.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 196, Price codes: A13 in paper copy, A01 in microfiche. Final Report, December 1976. 276 p, 32 fig, 46 tab, 105 ref.

Descriptors: *Cloud seeding, *Weather modification, *On-site tests, *Hail, *Colorado, Stochastic processes, Precipitation(Atmospheric), Data collections, On-site data collections, Sampling, Instrumentation, Data processing, Analytical techniques, Analysis, Meteorological data, Measurement, Monitoring, Statistical methods, Silver iodide, Summer, Hail suppression.

The National Hail Research Experiment conducted a randomized hail suppression test in northeast Colorado during the summers of 1972, 1973, and 1974. The experimental units were days on which storms were identified as 'threatening' a fixed target area, as determined by an objective radar criterion. The attempt was made to suppress hail in the target area on a randomized subset of these days by seeding storms with silver iodide. The effect of the seeding on hail and rain at the ground was studied by comparing the hailfall and rainfall on 'seed days' with that on control days, measured by networks of gages in the target area. The five volumes of this final report presented the procedures, the data, and the statistical analysis of seeding effects. At the onset, the total mass of hail at the ground in the target area was identified as the primary response variable for evaluating seeding effects on hailfall. The major conclusion of the experiment was that no statistically significant effect of seeding is detected. The result is true for the hail mass and all other response variables considered, regardless of the method of analyzing the data. The statistical significance level was chosen to be 10%, using a two-tailed test. The 90% confidence limits for the ratio of mean hail mass on seed to that on control days are 0.4 and 4.9. Those for rain are 0.8 and 7.4. Both of the test results assume lognormal distributions. In other words, it is unlikely that seeding clouds with silver iodide, with the technique used in this experiment, reduces hail by more than 60% in northeast Colorado. The results of the statistical experiment itself do not allow this result to be generalized to other areas, other climates, or other seeding strategies. (See W78-02604 thru W78-02607) (Humphreys-ISWS)
W78-02603

FINAL REPORT-NATIONAL HAIL RESEARCH EXPERIMENT, RANDOMIZED SEEDING EXPERIMENT 1972-1974, VOLUME II, PRECIPITATION MEASUREMENTS,
National Center for Atmospheric Research, Boulder, CO.
J. E. Dye, A. J. Heymsfield, I. Paluch, and D. W. Breed.
Available from the National Technical Information Service, Springfield, VA 22161, as PB-266 197, Price codes: A23 in paper copy, A01 in microfiche. Final Report, December 1976. 537 p, 79 fig, 13 tab, 7 ref.

Descriptors: *Cloud seeding, *Weather modification, *Hail, *On-site tests, *Colorado, *Precipitation(Atmospheric), Data collections, On-site data collections, Sampling, Instrumentation, Data processing, Analytical techniques, Analysis, Meteorological data, Measurement, Rainfall, Distribution patterns, Networks, Hail/Rain separator.

The hail and rainfall data collected in the National Hail Research Experiment (NHRE) during the randomized hail suppression experiment conducted in northeast Colorado during the hail

seasons of 1972, 1973, and 1974 were described and tabulated in this volume. The precipitation network data presented were used in Volume I of the NHRE final report to assess the effects of seeding on the hail and rainfall at the ground. The volume included: a description of the instruments used in the experiment--the hailpad, hail/rain separator, and weighing raingages; a description and map of the instrument network in the experimental area; a discussion of the extensive edit procedures employed to verify the data; a discussion of the limitations of the edited data set; and finally, the daily tabulations of the measurements of each instrument for each declared hail day. Although the weighing raingage and, for part of the experiment, the hail/rain separator provided time-resolved measurements of hail and rainfall, only daily rain and hail totals were presented. Time-resolved data, as well as all the data presented, are available from NHRE on seven-track magnetic tape on request. (See also W78-02603) (Humphreys-ISWS)
W78-02604

FINAL REPORT-NATIONAL HAIL RESEARCH EXPERIMENT, RANDOMIZED SEEDING EXPERIMENT 1972-1974, VOLUME III, METEOROLOGICAL SUMMARY,
National Center for Atmospheric Research, Boulder, CO.
J. C. Fankhauser, A. C. Modahl, C. G. Mohr, and M. E. Solak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 198, Price codes: A14 in paper copy, A01 in microfiche. Final Report, December 1976. 313 p, 58 fig, 58 tab, 18 ref.

Descriptors: *Weather modification, *Cloud seeding, *On-site tests, *Colorado, *Synoptic analysis, *Weather data, Meteorological data, Maps, Data collections, Hail, Precipitation(Atmospheric), Analysis, Data processing, Analytical techniques, Statistical methods, Networks, Meteorology, Climatic data, Radiosondes, Weather patterns, Dew point, Air temperature, Winds, Weather.

This volume presented a summary of meteorological information pertinent to each of the 57 hail days declared during the 1972, 1973, and 1974 field seasons in the National Hail Research Experiment (NHRE). An adequate description of synoptic scale atmospheric structure on hailstorm days is essential for: (1) investigation of possible predictors and/or covariates which might prove useful in the design, conduct, and evaluation of a suppression experiment, and (2) improving forecasts, both on the long and short time scale, as aids in operational planning and execution. Material supporting the meteorological summaries in all cases included a 500-mb chart, a surface sectional synoptic chart, and a thermodynamic diagram showing a plot of temperature, dew point, and wind vectors for each sounding selected to represent the larger scale meteorological conditions. A table listing thermodynamic and wind data at 10-mb intervals supplemented the graphical sounding plot in each instance. (See also W78-02603) (Humphreys-ISWS)
W78-02605

FINAL REPORT-NATIONAL HAIL RESEARCH EXPERIMENT, RANDOMIZED SEEDING EXPERIMENT 1972-1974, VOLUME IV, RADAR SUMMARY,
National Center for Atmospheric Research, Boulder, CO.
G. B. Foote, R. C. Srivastava, J. C. Fankhauser, F. I. Harris, and T. J. Kelly.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 199, Price codes: A15 in paper copy, A01 in microfiche. Final Report, December 1976. 328 p, 60 fig, 60 tab, 20 ref.

Descriptors: *Cloud seeding, *Weather modification, *Remote sensing, *On-site tests, *Colorado, Precipitation(Atmospheric), Data collections, Radar, On-site data collections, Sampling, Stochastic processes, Hail, Analytical techniques, Meteorological data, Measurement, Monitoring, Weather patterns, Surveys, Statistical methods, Rainfall, Analysis, Data processing, Distribution patterns.

Radar observations played a central role in the conduct of the randomized seeding experiment carried out by the National Hail Research Experiment in the years 1972, 1973, and 1974. Criteria based on radar observations of storm intensity and movement were used to decide which days would be included as experimental units, and the actual conduct of the seeding operations relied heavily on real-time radar displays. The Radar Summary provided: (1) documentation of the characteristics of those storms that occurred in and around the experimental target area; (2) a basis for stratifying the surface hail data according to storm type and intensity; (3) data for an alternative evaluation of the randomized seeding experiment using some integrals of the S-band radar reflectivity factor as the response variable; (4) data for a post-analysis of how well the cloud seeding operation was actually conducted relative to what was intended; and (5) data which could be useful in the search for hailfall predictors and covariates. The radar observations presented were made by the S-band Grover radar, operated by the National Center for Atmospheric Research. A description of the radar system, the calibration techniques, and other data handling procedures were given. The data analysis methods were discussed, and several summary tables were presented, along with summaries of radar cell characteristics for each of the 57 sample days of the statistical experiment. (See also W78-02603) (Humphreys-ISWS)
W78-02606

FINAL REPORT-NATIONAL HAIL RESEARCH EXPERIMENT, RANDOMIZED SEEDING EXPERIMENT 1972-1974, VOLUME V, HAIL DECLARATION PROCEDURES AND SEEDING OPERATIONS,
National Center for Atmospheric Research, Boulder, CO.
R. W. Sanborn, J. C. Fankhauser, G. B. Foote, C. A. Knight, and G. Langer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 200, Price codes: A10 in paper copy, A01 in microfiche. Final Report, December 1976. 211 p, 16 fig, 13 tab, 13 ref.

Descriptors: *Cloud seeding, *On-site tests, *Colorado, *Weather modification, Testing procedures, Silver iodide, Aircraft, Application equipment, Decision making, Hail, Methodology, Instrumentation, Analytical techniques, Analysis, Weather data, On-site data collections, Precipitation(Atmospheric), Surveys, Remote sensing, Hail suppression.

Discussions of the Hail Day declaration procedures, operational seeding techniques, seeding materials used, and characteristics of the seeding agents for the hail suppression experiment carried out during 1972, 1973 and 1974 were included in this volume. The volume also presented analyses for each declared hail day, both 'seed' and 'no seed,' in order to determine how well the stated declaration procedures were met. Additional information was included that illustrates whether or not seeding operations were carried out for the proper period of time required by the criteria. From this an index of seeding coverage was developed. It was decided that a seeding method was required that would allow for the accurate placement of the nucleating material in the updraft near the -5 C isotherm, normally about 5 to 6 km MSL in Colorado during the summer months. The vertically-fired, airborne rocket was selected as the primary system, with cloud base flares to be used as the backup system. (See also W78-02603) (Humphreys-ISWS)
W78-02607

3C. Use Of Water Of Impaired Quality

PROBABILITY OF DROUGHT AND SECONDARY SALINIZATION OF SOILS, (IN RUSSIAN),
Moscow State Univ. (USSR). Dept. of General Soil Science.
V. A. Kovda, S. K. Onishchenko, and B. G. Rozanov.
Biol Nauki 19(2), p 7-20, 1976.

Descriptors: *Drought, *Saline soils, Crops, Grain, *Irrigation, *Probability, Reclamation.

The new high-yield grains are less drought-resistant than traditional varieties. Drought periods are predicted for 1983-86 and 1994-97. On the basis of historical, climatic, soil, botanical, hydrological and geogrphical factors plus repetitiveness and severity of droughts in the past, a map of the world is given with delineation of areas into 9 categories corresponding to increasing degrees of probability of drought. To address the problem of secondary salinization of the soil caused by irrigation, a table of complex reclamation measures is provided.--Copyright 1977, Biological Abstracts, Inc.
W78-02234

PROCESS DESIGN FOR GEOTHERMAL POWER,
California Univ., Berkeley.
For primary bibliographic entry see Field 8C.
W78-02278

WATER REUSE,
Irrigation Commission, Lucknow (India).
A. C. Chaturvedi.
Journal of the Institution of Engineers (India), Vol. 57, Part EN 3, p 108-111, June, 1977.

Descriptors: *Return flow, *Water reuse, *Ozone, *Storm water, *Irrigation practices, Water resources development, Screens, Industrial water, Overflow, Combined sewers, Tertiary treatment, Waste water treatment, India.

Because water supplies in Uttar Pradesh, India, are limited and often contaminated, reuse of waste water, although an expensive process, becomes attractive because of the gain in water resources. The waste water treatment plant plans to reclaim 17 mgd of municipal waste water for industrial cooling purposes. Biological treatment methods are used to remove BOD, excess lime softening is used to remove phosphates, and recarbonation is used to lower hardness. Experiences with the reuse of waste water for irrigation are described. Reuse and conservation of water used in the textile industry is suggested to lessen the drain on water resources of the surrounding areas. Microscreening to remove suspended solids from combined sewer overflows and the use of ozone to remove color, taste, odor, and microorganisms from storm water are described. In a pilot plant coarse screens were used to remove large particles from waste water before microscreening. Screened effluent is then fed at a controlled rate to a continuous co-current contact chamber for ozonation. Analyses of treated effluent indicated that ozonation resulted in reductions in all of the contaminants except total phosphorus. The use of treated combined sewer overflows is suggested for irrigation, artificial recreational lakes, and other industrial purposes. (Schulz-FIRL)
W78-02297

3D. Conservation In Domestic and Municipal Use

WATER CONSERVATION IN CALIFORNIA.
California State Resources Agency, Sacramento. Dept. of Water Resources.
For primary bibliographic entry see Field 3B.

W78-02409

THE CALIFORNIA DROUGHT - 1976.
California State Resources Agency, Sacramento. Dept. of Water Resources.
For primary bibliographic entry see Field 3B.
W78-02410

THE CALIFORNIA DROUGHT - 1977, AN UPDATE.
California State Resources Agency, Sacramento. Dept. of Water Resources.
For primary bibliographic entry see Field 3B.
W78-02411

THE CONTINUING CALIFORNIA DROUGHT.
California State Resources Agency, Sacramento. Dept. of Water Resources.
For primary bibliographic entry see Field 3B.
W78-02412

WATER SUPPLY, LAND USE, AND URBAN GROWTH,
Santa Clara Valley Water District, CA.
For primary bibliographic entry see Field 4A.
W78-02448

INFLUENCE OF METERING, PRICING, POLICIES AND INCENTIVES ON WATER USE EFFICIENCY,
New South Wales Univ., Kensington (Australia). School of Economics.
For primary bibliographic entry see Field 6D.
W78-02572

3E. Conservation In Industry

COAL, ENERGY STUDY ISSUE, UPDATE, 1976,
Wyoming Univ., Laramie. Water Resources Research Inst.
J. Davidson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 645, Price codes: A06 in paper copy, A01 in microfiche. Amended Completion Report, 1976 101 p, 22 tab. OWRT C-6188(No 5220)(2).

Descriptors: *Resource development, *Coal, *Energy, *Research priorities, Wyoming, North Dakota, Montana, Great Plains, *Regional development, Energy resources development, *Research needs, *Northern Great Plains, Information transfer.

Results are presented of a follow-up to a study conducted in 1973 (See W74-07056) by the Water Resources Research Centers/Institutes of Wyoming, North Dakota, and Montana. The 1973 study investigated the issues and concerns relating to the expected development of coal/energy resources in the Northern Great Plains region. The areas of concern include: trace elements, atmospheric effects, coal resources mining techniques and waste disposal problems, surface resources (including reclamation of strip-mined areas), water resources (quality and quantity), economic and social issues, institutional issues, and general technology. The objective of the study reported here was to determine to what extent regional (state) study priorities had changed in the period between 1973 and 1976. A second objective was to provide a limited overview of the studies that had been conducted or were underway or planned in the region and the extent of funding. A third and final objective was to re-examine briefly the means and mechanisms for meeting state and regional study and information transfer needs. The report is organized by eleven principal issues, with the needs, priorities, and studies given for each. In general, the study needs spelled out in 1973 are still the primary concerns in 1976.
W78-02225

EXTRACTION OF GEOTHERMAL ENERGY BY TWO-LOOP SYSTEMS,
Krzhizhanovskii Energeticheskii Inst., Moscow (USSR).
For primary bibliographic entry see Field 8C.
W78-02276

PROCESS DESIGN FOR GEOTHERMAL POWER,
California Univ., Berkeley.
For primary bibliographic entry see Field 8C.
W78-02278

GEOTHERMAL HEAT: TO WHAT EXTENT CAN IT SATISFY OUR ENERGY HUNGER,
For primary bibliographic entry see Field 4B.
W78-02280

GEOTHERMAL DEVELOPMENT OF THE SALTON SEA,
DSS Engineers, Inc., Ft. Lauderdale, FL.
C. D. Hornburg.
Chemical Engineering Progress, Vol. 73, No. 7, p 89-94, July, 1977. 4 fig, 3 tab, 16 ref.

Descriptors: *Geothermal studies, *Brines, *Mineral industry, Energy, Thermal waters, Metals, Sodium chloride, Costs, California, *Salton Sea(Calif).

The development of a geothermal energy supply provides an opportunity for groups of related industries to be joined together for synergetic production in an optimum economic manner. For the most part, those industries that consume large amounts of thermal energy are not indigenous to geothermal resource areas. By concentrating plants which could make use of dissolved salts and metals in geothermal brine areas, availability of raw materials and inexpensive power would be assured. Sodium chloride processing is discussed in detail; because thermal energy would be at hand, it would be cost-effective to utilize the power necessary to convert low value NaCl to highly-marketable caustic and chlorine. Overall, the Salton Sea Known Geothermal Resource Area in California shows potential for this sort of energy-intensive mineral extraction activity. (Eberle-NWWA)
W78-02281

POWER FROM HOT GEOTHERMAL BRINES,
Rotoflow Corp., Los Angeles, CA.
For primary bibliographic entry see Field 8C.
W78-02282

ECONOMIC ANALYSIS OF GEOTHERMAL ENERGY,
Battelle-Pacific Northwest Labs., Richland, WA.
C. H. Bloomster.
Chemical Engineering Progress, Vol. 72, No. 7, p 89-95, July, 1976. 11 fig, 3 tab, 3 ref.

Descriptors: *Thermal power, *Cost analysis, Economics, *Computer models, Construction costs, Electric power costs, Operating costs, Income, Powerplants, Tax rate, *Geothermal energy, Binary cycle geothermal plants, Total flow geothermal plants.

In order to facilitate the complex undertaking of determining the costs of geothermal power for a given site, a computer program called GEOCOST has been developed by Battelle-Northwest Laboratories with funding from ERDA. GEOCOST combines both technical and economic factors in one systematic cost account framework. The program is composed of two parts: (1) a reservoir model, which calculates cash flows associated with exploration, drilling, fluid transmission and disposal, and reservoir operation. Annual operating expenses, including royalties, replacement well drilling, taxes, overhead, and maintenence are calculated for the life of the hypothetical power plant. (2) a power plant model, which includes submodels to simulate different power cycles (flashed steam, binary fluid, and total flow) and to estimate the resulting expenses and revenues for any given cycle. GEOCOST can simulate through varying rates of return on equity and debt, the debt-equity ratios, and tax rates. (Eberle-NWWA)
W78-02285

THE POTENTIAL FOR GEOTHERMAL STEAM,
Union Oil Co. of California, Los Angeles.
For primary bibliographic entry see Field 4B.
W78-02288

GEOTHERMAL ENERGY: ITS PROMISE FOR THE FUTURE.
Ground Water Age, Vol. 12, No. 2, p 20-29, October, 1977.

Descriptors: *Thermal power, *Thermal waters, *Geothermal studies, *Resource development, *Assessments, Costs, Electric power production, Utilities, Economics.

In contrast to the Geysers, a localized dry steam field that may total 2200 mw with equal hydrothermal potential nearby, the Imperial Valley of California is thought to have a development potential approximating 9000 mw. Such is the incentive for a geothermal resource assessment that has been systematized and expanded in recent years to include all 11 western states. The U.S. Geological Survey has estimated that the major available hydrothermal systems tabulated in this area represent about 8000 mw for 100 years, based on present-day electrical generating technology. Various private organizations have upgraded these estimates, extrapolating to account for the indicated presence of resources which have not yet been evaluated. Estimates of $600/kw to $950/kw for both power plant and geothermal reservoir development have been put forth for new installations. Electric utilities, energy firms and regulatory groups are all influential regarding the pace of geothermal exploitation. The uncertainties of the resource are more of a limitation at this point than is current technology, and only systematic assessment, demonstration, and development of hydrothermal power can dispel such questions. (Eberle-NWWA)
W78-02294

A CLOSED WATER REUSE SYSTEM FOR POWER PLANT COOLING AND DIGESTER HEATING,
Nihon Suido Consultants Co., Tokyo.
Y. Chiu, and W. Guey-Lee.
Water Resources Bulletin, Vol. 13, No. 6, p 1203-1214, December 1977. 2 fig, 1 tab, 5 ref.

Descriptors: *Water reuse, *Water quality, *Pollution abatement, *Powerplants, *Cooling, *Design, Municipal wastes, Water supply, Human population, Sewage, Treatment, Energy, Water resources, Mathematical models, Equations, Systems analysis, *Waste heat utilization, Digester heating, Energy generation, Maximum energy recovery.

Presented is a conceptual model consisting of closed water reuse and productive use of various types of wastes for energy generation. The sewage after treatment would be used as the cooling water for powerplants, and the resulting condenser discharge would be used as heating water for sludge digesters. The water would then be purified for municipal water supply for continuous use. The advantages of this system are that water resources and energy are conserved while various types of wastes, including waste heat, are controlled. With a preliminary system analysis, it appears that the design for the powerplant based on the total heating value of wastes and for the

digester capacity based on sewage sludge generation is feasible in terms of acquisition and full utilization of various types of wastes as generated in a single metropolitan area. The system as shown in this design is in balance among various factors, such as the generation rate of municipal refuse, municipal sewage, heat in the condenser discharge, and raw sewage sludge. (Bell-Cornell)
W78-02443

ECONOMIC AND FINANCIAL IMPACTS OF FEDERAL AIR AND WATER POLLUTION CONTROLS ON THE ELECTRIC UTILITY INDUSTRY.
Temple, Barker and Sloane, Inc., Wellesley Hills, MA.
For primary bibliographic entry see Field 5G.
W78-02518

THE COST OF CLEAN WATER IN AMMONIA, CHLORALKALI AND ETHYLENE PRODUCTION,
National Economic Models of Industrial Use and Waste Treatment Project, Houston, TX.
For primary bibliographic entry see Field 5G.
W78-02521

NEW SOURCES OF ENERGY: PROCEEDINGS OF THE CONFERENCE, VOLS. 2 AND 3, GEOTHERMAL ENERGY.
United Nations, New York.
For primary bibliographic entry see Field 4B.
W78-02541

TWO-DIMENSIONAL SIMULATION OF THE RAFT RIVER GEOTHERMAL RESERVOIR AND WELLS,
EG and G Idaho, Inc., Idaho Falls.
For primary bibliographic entry see Field 4B.
W78-02552

DEVELOPMENT DOCUMENT FOR EFFLUENT LIMITATIONS GUIDELINES AND NEW SOURCE PERFORMANCE STANDARDS FOR THE FISH MEAL, SALMON, BOTTOM FISH, CLAM, OYSTER, SARDINE, SCALLOP, HERRING, AND ABALONE SEGMENT OF THE CANNED AND PRESERVED FISH AND SEAFOOD PROCESSING INDUSTRY POINT SOURCE CATEGORY,
Environmental Protection Agency, Washington, DC. Effluent Guidelines Div.
For primary bibliographic entry see Field 5G.
W78-02578

3F. Conservation In Agriculture

THE EFFECT OF SHEEP GRAZING POLICY ON THE WATER BALANCE IN DESERT RANGES, (IN RUSSIAN),
Zh. A. Zhambakin, E. B. Aibasov, and K. Moldabekova.
Probl Osvo Pustyn' 1, p 55-59, 1976.

Descriptors: Artemisia, *Desert ranges, Ephemerae, *Grazing(Sheep), Moisture, Productivity, Ranges, Soils, *Water balance.

Deferred grazing in overgrazed Artemisia-Ephemerae ranges resulted in a 40% increase of range productivity followed by resumption of the ratio between plant aggregations, a 50% rise of moisture rotation and accumulation of precipitated H2O in winter.--Copyright 1977, Biological Abstracts, Inc.
W78-02224

OPTIMAL ALLOCATION AND MANAGEMENT OF AGRICULTURAL WATER,
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
Z. Abate.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 575, Price codes: A07 in paper copy, A01 in microfiche. PhD Dissertation, August, 1975. 117 p, 16 fig, 14 tab, 33 ref, 4 append.

Descriptors: *Model studies, *Water allocation(Policy), *Optimization, *Corn(Field), *Grain sorghum, *Wheat, Crop response, Crop production, Mathematical models, Dynamic programming, Linear programming, Soil moisture, Soil water, Water supply, Agricultural water, Optimal production, Yield coefficients, Crop yield.

This study analyzes a mathematical model to determine optimum values of the controllable factors influencing agricultrual production. The research is developed from a need to model situations in which the hydrologic and input resources are limited. This study focuses on irrigated and dryland farming systems with three crops; corn, sorghum and wheat. This methodology may easily be extended to other crops. A deterministic mathematical model is developed to describe the events that occur in applying irrigation water to the plant's root system. The available data for the model are classified into six stages based on the plant growth cycle. A nonlinear multiplicative production function for water is adopted. The total product of yield coefficients for all the stages times the adopted maximum yield for that particular crop explicitly determines the actual yield of the crop. Similarly, the potential yield at each stage is estimated. Dynamic programming is used to determine the amount of resources available for each crop. This analysis incorporates the following steps: (1) Starting with an estimate of the quantity of water allocated to each crop at each time period, dynamic programming is used to compute the total water used at each stage. (2) The particular quantity of water allocated to each crop becomes fixed based upon empirical data. Dynamic programming then determines the optimal allocations of the fixed supply of water by stages. The results of this study indicate that the yield coefficients are directly linked to the moisture deficit indices. A computer program is presented to handle the dynamic programming formulation of the problem. (Skogerboe-Colorado State)
W78-02226

SOLAR IRRIGATION SYSTEM BEGINS OPERATION IN NEBRASKA.
Irrigation Journal, Vol. 27, No. 5, p 37, September-October, 1977.

Descriptors: *Irrigation systems, *Pumping, *Solar radiation, Irrigation engineering, Costs, *Nebraska, *Solar energy, Irrigation wells, Water wells.

One of the country's first crop irrigation systems to be powered by solar energy began operating in July, 1977 in Mead, Nebraska. The solar unit, designed by the Masachusetts Institute of Technology's Lincoln Laboratory, will use approximately 120,000 solar cells to generate electricity. Builders of the system expect it to be an effective demonstration of an alternate energy source for irrigation, which surveys indicate consumes half the total energy used in Nebraska's agricultural production. There are an estimated 52,000 irrigation wells in the state which consume about $81 million worth of energy per year. The system operates 12 hours a day, pumping 1000 gallons of water per minute into irrigation pipes servicing an 80 acre field. In addition to irrigation, the solar power will be used for crop drying during the fall and winter. The experiment is being conducted by the MIT Lincoln Laboratory in conjunction with the University of Nebraska-Lincoln, and is sponsored by the Photovoltaic Conversion Program of ERDA's Division of Solar Energy. (Eberle-NWWA)
W78-02279

SOLAR ENERGY TO POWER IRRIGATION PUMPS.
For primary bibliographic entry see Field 8C.
W78-02291

IRRIGATION OF THE ARID LAND OF THE WORLD, (IN RUSSIAN),
I. S. Zonn.
Probl Osvo Pustyn' 2, p 13-17, 1976.

Descriptors: *Arid lands, Farming, *Irrigation systems, Land management, Technology, Irrigated land.

The area of irrigated lands in arid zones is presently about 85 million ha, or 3% of the world's irrigated lands. Prospects of large-scale irrigational farming in the area under investigation will be quaranteed by: designing and constructing technically improved irrigational systems at the lowest water losses, steady operation of all units of the irrigational system envisaged by the project and involvement of new technological methods in the land use policy.--Copyright 1976, Biological Abstracts, Inc.
W78-02382

CHANGES IN THE ECOLOGY OF AREAS ADJACENT TO IRRIGATION SYSTEMS, (IN RUSSIAN),
Kuban Agricultural Inst., Krasnodar (USSR).
N. A. Volkonskii.
Pochvovedenie 4, p 152-155, 1976.

Descriptors: *Ecology, *Irrigation systems, Kazakh-SSR, *Phytocenosis, Productivity, *USSR.

The action of reclamation on ecological conditions of adjacent areas and the decrease in productivity of the latter are considered. Exogenous changes of phytocenoses leading to a decrease in productivity of these areas was observed. Absence of ecological investigations of edaphogenic changes makes the evaluation of water economy designs with respect to ecological efficiency impossible.--Copyright 1977, Biological Abstracts, Inc.
W78-02388

COMPUTER MODELING TO MAXIMIZE WATER USE EFFICIENCY AND REDUCE ENERGY IN IRRIGATION,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
J. R. Gilley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 776, Price codes: A03 in paper copy, A01 in microfiche. Nebraska Water Resources Research Institute, Lincoln, Completion Report, October 1, 1977. 30 p, 10 fig, 9 ref. OWRT A-038-NEB(2), 14-34-0001-7058.

Descriptors: *Corn growth model, *Irrigation scheduling, Soil-water-plant relationships, Energy, Soil moisture, *Computer models, Mathematical models, *Water utilization, *Crop production, Irrigation water, *Plant growth, *Irrigation efficiency.

A simplified irrigation scheduling model, IRRIGATE, has been developed as an educational tool for use by University personnel and in extension programs. Irrigations are scheduled using the basic premise of maximizing yields with a minimum of applied irrigation water. Use of IRRIGATE has grown rapidly in Nebraska; in addition to being used as an educational tool it was used by private individuals, private irrigation scheduling companies, irrigation districts and others to schedule irrigations for approximately 25,000 acres during the 1977 season. A mathematical model, CORNGRO, has been developed to predict daily crop water use, plant growth and crop yield for corn. CORNGRO has the capability

of predicting corn yield as a result of different irrigation timing and amounts. The model can be useful in evaluating irrigation scheduling procedures in terms of yield, water conservation, energy conservation, producing costs, and analyzing alternate levels of water applied. The tests of the model using data available from Mead, Nebraska indicate the model has considerable predictive power, although not all of the dynamics of crop growth are modeled in precise detail.
W78-02404

WATER CONSERVATION IN CALIFORNIA.
California State Resources Agency, Sacramento. Dept. of Water Resources.
For primary bibliographic entry see Field 3B.
W78-02409

THE CALIFORNIA DROUGHT - 1976.
California State Resources Agency, Sacramento. Dept. of Water Resources.
For primary bibliographic entry see Field 3B.
W78-02410

THE CALIFORNIA DROUGHT - 1977, AN UPDATE.
California State Resources Agency, Sacramento. Dept. of Water Resources.
For primary bibliographic entry see Field 3B.
W78-02411

THE CONTINUING CALIFORNIA DROUGHT.
California State Resources Agency, Sacramento. Dept. of Water Resources.
For primary bibliographic entry see Field 3B.
W78-02412

MODERATE-TERM WATER STRESSES AND ASSOCIATED CHANGES IN SOME PHOTOSYNTHETIC PARAMETERS IN COTTON,
Agricultural Research Council, Trumpington (England).
For primary bibliographic entry see Field 2I.
W78-02462

AN ANALYTICAL STUDY ON THE ECOPHYSIOLOGICAL ADAPTATION OF SOYBEAN PLANTS TO LIMITED WATER SUPPLY,
Tokyo Univ. (Japan). Dept. of Botany.
For primary bibliographic entry see Field 2I.
W78-02465

ESTUARY IRRIGATION EFFECT ON SOIL-FORMING PROCESS IN CENTRAL KAZAKH SSR, (IN RUSSIAN),
Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Inst. of Soil Science.
M. A. Bikmukhametov, and V. A. Zhukova.
Probl Osvoeniya Pustyn'. 4, p 41-47, 1973.

Descriptors: *Irrigation effects, *Soil formation, *Grasslands, *Fertility, Estuaries, Soil properties, Grazing, Forages, Deserts, Sierozems, Crop response, Kazakh-SSR, USSR.

Estuary irrigation in northern regions of the desert favors the formation of soils, of hydromorphic series. Estuary-meadow soils possess valuable agrochemical and hydrophysical properties. Estuary irrigation reduces the developement of valueless fodder crops improving that of meadow grasses and increasing yield capacity of estuary grazing lands.--Copyright 1974, Biological Abstracts, Inc.
W78-02597

IRRIGATION NUMBER: A NEW TECHNIQUE TO EVALUATE IRRIGATION ADVANCE DISTANCE,
Indian Inst. of Tech., Kharagpur. Dept. of Agricultural Engineering.
G. Sastry, and S. C. Agarwal.
J Agric Eng Res. 18(3), p 189-195, 1973.

Descriptors: *Irrigation systems, *Forecasting, *Dimensional analysis, *Curves, Evaluation, Inflow, Infiltration, Hydraulic conductivity, Surface irrigation, Analytical techniques, Mathematical studies, *Irrigation advance distance.

Prediction of irrigation advance distance for a given set of initial conditions such as slope of land surface, inflow stream per unit top width of flow, infiltration characteristics and hydraulic conductivity of soil bed, is important in order to design efficient surface irrigation systems. A dimensional analysis of variables involved in water advance phenomenon was made to derive a satisfactory equation. The data available at this Research Station was analyzed and fitted by least square method of curve fitting to yield an equation of the type $M = A(N)B$ (where $M = gx\ K2$, $N = gt\ K$, A = coefficient and B = index, X = advance distance, t = advance time K = hydraulic conductivity of the soil bed.) for a given irrigation number, V3Non gv. (The equation derived can be used to predict advance distance for a given normal velocity, VNO, infiltration index, n and kinematic viscosity of fluid used.) The slope of each curve B is observed to be fairly constant and coefficient A was related with irrigation number. An irrigation advance function relating these dimensionless parameters is proposed.--Copyright 1974, Biological Abstracts, Inc.
W78-02625

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

IMPROVED DESIGN AND OPERATING CRITERIA FOR RURAL WATER DISTRICTS (PHASE II),
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 6D.
W78-02206

AN ANALYSIS OF THE EFFECTIVENESS OF LAND USE REGULATIONS REQUIRED FOR FLOOD INSURANCE ELIGIBILITY,
Mississippi State Univ., Mississippi State. Div. of Business Research.
For primary bibliographic entry see Field 6F.
W78-02207

EFFICIENCY IMPACTS OF COST SHARING ON SHORELINE MANAGEMENT,
National Bureau of Standards, Washington, DC.
For primary bibliographic entry see Field 6C.
W78-02208

A CRITIQUE OF THE NATIONAL WATER COMMISSION ANALYSIS OF COST SHARING,
Cornell Univ. Agricultural Experiment Station, Ithaca, NY. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6B.
W78-02214

A COMPARISON BETWEEN CONVENTIONAL AND LANDSAT-BASED HYDROLOGIC MODELING: THE FOUR MILE RUN CASE STUDY,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W78-02232

DEBRIS OF THE CHENA RIVER,
Cold Regions Research and Engineering Lab., Fairbanks, AK. Alaska Projects Office.
For primary bibliographic entry see Field 2J.
W78-02238

PORT IMPROVEMENT DESIGN CRITERIA FOR TEXAS COAST,
Texas A and M Univ., College Station. Ocean Engineering Program.
For primary bibliographic entry see Field 8B.
W78-02245

STORM TIDE FREQUENCIES FOR CAPE FEAR RIVER,
National Weather Service, Silver Spring, MD. Office of Hydrology.
For primary bibliographic entry see Field 8B.
W78-02247

TECHNIQUE FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
W. J. Randolph, and C. R. Gamble.
Tennessee Department of Transportation, (Nashville), 1976. 52 p, 9 fig, 4 tab, 11 ref.

Descriptors: *Flood frequency, *Peak discharge, *Estimating, *Analytical techniques, *Tennessee, Regression analysis, Data collection, Gaging stations, Flow rates, Flood forecasting, Frequency analysis, Flood recurrence interval, Regional analysis, *Maximum known floods(Tenn).

Methods for estimating the magnitude and frequency of floods on natural streams in Tennessee are described. Flood-frequency characteristics are defined for 281 gaging stations in Tennessee and adjoining states having 10 or more years of record not significantly affected by man-made changes. The frequency characteristics were related to basin characteristics by miltiple regression techniques and the equations derived can be used to estimate the magnitude of future floods with reccurrence intervals of as much as 100 years on ungaged streams if contributing drainage area of the site is known. At or near gaged sites, the use of a weighted average of the regression results and the gaging station data is recommended. (Woodard-USGS)
W78-02416

WATER RESOURCES DATA FOR TENNESSEE, WATER YEAR 1976.
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02417

WATER RESOURCES DATA FOR WISCONSIN WATER YEAR 1976.
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02418

WATER RESOURCES DATA FOR NEW MEXICO, WATER YEAR 1976.
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02419

WATER RESOURCES DATA FOR NEW HAMPSHIRE AND VERMONT, WATER YEAR 1976.
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02420

WATER RESOURCES IN WESTERN CORTLAND COUNTY, NEW YORK: HYDROLOGIC DATA FOR 1972-75 AND PROGRESS REPORT,
Geological Survey, Ithaca, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02422

PRELIMINARY FLOOD-FREQUENCY RELATIONS FOR URBAN STREAMS, METROPOLITAN ATLANTA, GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
H. G. Golden.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 504, Price codes: A02 in paper copy, A01 in microfiche. Water-Resources Investigations 77-57, August 1977. 16 p, 6 fig, 2 tab, 15 ref.

Descriptors: *Flood frequency, *Peak discharge, *Urban hydrology, *Flood forecasting, *Analytical techniques, Hydrologic data, Equations, Storm runoff, Cities, Georgia, *Atlanta(Ga), Urban flood frequency, Urban streams.

A method is presented for estimating the magnitude and frequency of floods for urban streams in metropolitan Atlanta. The method is based on adjustments to the natural stream flood-frequency and rainfall-frequency characteristics of the local area as defined by urban flood studies in other areas. The effects of urbanization on flood-peak runoff are estimated from the percentage of drainage basin that is impervious and the percentage of drainage area served by storm sewers. Equation are presented for estimating the 2-, 5-, 10-, 25-, 50-, and 100-year flood peak discharges for basin sizes from 0.5 to 100 square miles in the Atlanta metro area. Data from 12 urban streams in the Atlanta area were used to obtain a qualitative verification of the 2- and 100-year estimating equations. Hydrologic data are presently being collected for a study that will provide a data base for use in hydrologic models to develop more reliable urban flood-frequency relations. (Woodard-USGS)
W78-02423

HYDROLOGIC RECONNAISSANCE OF THE EASTERN NORTH SLOPE, ALASKA, 1975,
Geological Survey, Anchorage, AK. Water Resources Div.
J. M. Childers, C. E. Sloan, J. P. Meckel, and J. W. Nauman.
Available from Branch of Distribution, USGS, Box 25425, Federal Ctr. Denver, CO 80225. Open-file report 77-492, 1977. 65 p, 35 fig, 5 tab, 10 ref.

Descriptors: *Hydrologic data, *Streamflow, *Springs, *Floods, *Alaska, Data collections, Flow rates, Channel morphology, Ice, Water resources, Lakes, Aquatic life, Invertebrates, Arctic, *North slope(Alas).

The part of the Arctic coast of Alaska between the Colville River and the Canadian boundary was visited in April, August, and November 1975. The study area is characterized by its cold climate and is largely uninhabited, but oil and gas discoveries have spurred development of parts of the area. Sensible, coordinated development requires information about water resources. The purpose of the April reconnaissance was to locate winter streamflow and describe its quantity and quality. A followup summer trip was made in August to determine the flood characteristics of selected streams by measuring channel geometry in relation to bankfull discharge and the maximum evident flood and by estimating channel roughness. In addition, one lake was sampled, the discharge of a few springs was measured, and samples of spring water were taken. Because streamflow in August was assumed to be representative of normal summer flow, water quality was examined in streams for which flood surveys had been made. Samples of aquatic invertebrate populations were taken from most sites on the April and August trips. Another reconnaissance trip from Prudhoe Bay east to Canada was made in November to measure discharge in selected streams and springs, to measure ice thickness and water depth in selected lakes, and to collect water samples for water-quality analyses. Tables of data, photographs, and maps are included. (Woodard-USGS)
W78-02424

TIME OF TRAVEL OF SOLUTES IN MISSISSIPPI RIVER FROM BELLE CHASSE TO THE VICINITY OF HEAD OF PASSES, LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W78-02426

MAP SHOWING DRAINAGE BASINS AND LOCATION OF STREAMFLOW-MEASURING SITES, FAIRFAX COUNTY, VIRGINIA,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02431

TECHNIQUES FOR ESTIMATING FLOOD DISCHARGES FOR OKLAHOMA STREAMS,
Geological Survey, Reston, VA; and Oklahoma City, OK. Water Resources Div.
W. O. Thomas, Jr, and R. K. Corley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 402, Price codes: A09 in paper copy, A01 in microfiche. Water-Resources Investigations 77-54, June 1977. 170 p, 20 fig, 5 tab, 13 ref, 3 append.

Descriptors: *Flood forecasting, *Peak discharge, *Frequency analysis, *Statistical models, *Oklahoma, Streams, Flow rates, Small watersheds, Large watersheds, Regression analysis, Flood frequency, Rainfall-runoff relationships, Model studies, Urbanization, Effects, Streamflow.

Statewide(Oklahoma) regression equations are defined for estimating peak discharges of floods having recurrence intervals ranging from 2 to 500 years. Contributing drainage area, main-channel slope and mean annual precipitation are the independent variables required for estimating flood discharges for rural streams. For urban streams the percentage of the basin that is impervious and served by storm sewers also is required. The regression equations are applicable for watersheds draining less than 2,500 sq mi that are not significantly affected by regulation. For rural streams, the regression equations are presented in graphical form for easy application. Annual peak data, basin and climatic characteristics, log-Pearson Type III statistics, and the flood-frequency relations are presented for 188 gaging stations. (Woodard-USGS)
W78-02436

VALUE OF INFORMATION IN RESERVOIR OPTIMIZATION,
Department of the Environment, Ottawa (Ontario). Hydrology Research Div.
V. Klemes.
Water Resources Research, Vol 13, No 5, p 837-850, October 1977. 8 fig, 3 tab, 21 ref.

Descriptors: *Reservoir operation, *Optimization, Hydrology, Economics, *Dynamic programming, Reservoir storage, *Reservoir releases, Probability, *Risks, Stochastic processes, Algorithms, Size, Equations, Mathematical models, Operations research, *Operating policy, Sensitivity, Loss minimization, Quadratic loss function.

Numerical experiments with operation policy optimization for a reservoir with a random log normal input demonstrated: a negligible sensitivity of results to the assumed form of input distribution; a near optimality of the policy 'draft equals input mean' for any reservoir size and any size of input sample used for the policy development; and a similarity between the effects of hydrologic and economic uncertainties. In particular, it was shown that the so-called standard policy, 'draft equals target,' arises from any optimal policy as either hydrologic or economic uncertainties grow beyond limits. While there was a clear hierarchy of optimal policies governed by the amount of information underlying the optimization if operation results were assessed vis-a-vis expected values and the true input population, the hierarchy was highly distorted when it was judged from the performance of individual policies on a 10-year sample from the true input population, representing an actual future operation period. It was also found that the degree of optimality of a given policy did not depend on the degree to which the underlying input model and its parameters agreed with the true input population, but rather on the similarity of the features of the 'historic' sample underlying a given policy and the 'future' 10-year sample on which the policy performance was tested. (Bell-Cornell)
W78-02445

WATER SUPPLY, LAND USE, AND URBAN GROWTH,
Santa Clara Valley Water District, CA.
J. K. Romm.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 103, No WR2, p 271-284, November 1977. 4 fig, 4 tab, 2 ref.

Descriptors: *Land use, *Water supply, *Planning, *Population, *Social needs, Water distribution(Applied), Water consumption(Except consumptive use), Water demand, Water utilization, Design, Water allocation(Policy), *Land usage planning, Residential use.

The availability of a water supply does not determine the population growth or land use that will be supported by that supply. Water needs vary between uses, and water may be reallocated from one use to another. The same amount of water needed to serve a low population at low densities will support a larger population at a higher density due to reduced outdoor use. A reallocation of water from agricultural to domestic and industrial use permits a greater population. Therefore, it is not the availability of water supply or lack thereof that permits or constrains growth but rather the political decisions by cities and counties related to economics, social factors, and land use. Analysis shows that land-use projections represent a more reliable basis than population for the determination of future supplemental water requirements and the design of water distribution systems. (Bell-Cornell)
W78-02448

CONTROLLING AQUATIC WEEDS,
New York Sea Grant Advisory Service, Albany.
For primary bibliographic entry see Field 5G.
W78-02500

LABORATORY TRIALS OF A NEW TRIAZINE HERBICIDE (DPX 3674) ON VARIOUS

AQUATIC SPECIES OF MACROPHYTES ALGAE,
Agricultural Research Council, Kidlington (England). Weed Research Organization.
For primary bibliographic entry see Field 5G.
W78-02516

STATUS, PROBLEMS, ADVANCES AND ECONOMICS OF EUCHEUMA FARMS,
M. S. Doty, and V. B. Alvarez.
Marine Technology Society Journal- Vol. 9, No. 4, p. 30-36, April-May, 1975. 7 fig, 3 tab, 4 ref. 04-3-158-29.

Descriptors: *Algae, *Harvesting of algae, Rhodophyta, Farms, Aquatic plants, Seasonal, Growth rates, Reproduction, Cultivation, Aquiculture, Economics, *Eucheuma, Philippines, Senescence, Carrageenan, Ice-ice.

Eucheuma, a tropical red algal seaweed which is a source of the galactan colloid, carrageenan, is farmed successfully only in the Philippines. Carrageenan is important in the food and dairy industries. Farming consists of lashing vegetative cuttings to polymer filament nets or lines on bottom areas of reef flat. Problems of cultivation center around senescence and seasonality. Senescence has been encountered when efforts have been made to improve the growth rate through use of a more fertile environment, and is thought to be due to an imbalance of light, temperature, water quality, and water movement. Senescence does not occur under normal conditions, and growth may continue indefinitely. Farming procedures take advantage of this indefinite growth: (1) small plants are harvested from a crop for marketing; (2) vacant sites are planted with pieces from the largest plants, thereby improving the crop genetically; (3) full-grown plants are trimmed to half size and sold; (4) when pieces grow to full size, the process is repeated. The seasonal problem, known as ice-ice, involves loss of pigment on segments of the thalli, which then dissolve away if the fertilizer regime is not immediately improved. A new strain of Eucheuma has recently been found which is apparently resistent to ice-ice, and exhibits a very high growth rate (4.77-5.64% weight increase per day in tests). (Lynch-Wisconsin)
W78-02571

FLOOD PLAIN INFORMATION: LITTLE CREEK, PRINCE WILLIAM COUNTY, VA,
Army Engineer District, Baltimore, MD.
Prepared for Prince William County, VA, April 1975, 20 p, 13 fig, 9 plates, 8 tab.

Descriptors: *Virginia, *Flood forecasting, *Flood data, *Flood recurrence interval, Floods, Flood flow, Indirect flood measurement, Streamflow forecasting, Design flood, Storms, Historic floods, Flood frequency, Flood stages, Peak discharge, Stage-discharge relations, Flood damage, Flood plains, Standard Project Flood, Flood protection, Land use, Planning, *Little Creek(VA), Prince William County(VA), Triangle(VA), Intermediate Regional Flood.

The study area includes approximately four miles of the main stream and flood plain on either side of Little Creek in Prince William County, VA. A large portion of the drainage basin is within Quantico Marine Base. The upper portions of the flood plain are moderately developed, but the lower portion is undeveloped except for the Quantico golf course. The county is one of the fastest growing in the country; increasing land development pressures on the flood plain are expected. There are no stream gages on Little Creek. Flood data were obtained from topographic maps, field studies, aerial photographs, and flood records from other nearby watersheds. Flooding may occur at any time of year, and results from heavy general rain or intense local thunderstorms. Six bridges and four buildings spanning the stream channel are obstructive to the Intermediate Regional Flood. The worst known flood, a result of Tropical Storm Agnes, occurred in June 1972. No official record of past flooding is available. Close to the mouth of Little Creek, the Intermediate Regional Flood is expected to crest at 17.6 feet mean sea level (msl), and discharge 4,000 cubic feet per second (cfs), while the Standard Project Flood will crest at 18.3 feet msl, and discharge 5,500 cfs. These floods would affect some residential and commercial properties. The data contained in this report are intended for use in making land use planning and managment decisions concerning flood plain utilization. (Nessa-NC)
W78-02623

FLOOD PLAIN INFORMATION: MILL RUN, BLAIR COUNTY, PENNSYLVANIA.
Army Engineer District, Baltimore, MD.
Prepared for Blair County Planning Commission, January 1974, 26 p, 2 fig, 16 plates, 5 tab.

Descriptors: *Pennsylvania, *Indirect flood measurement, *Flood forecasting, *Flood profiles, *Flood data, *Flood protection, Floods, Regional flood, Flood flow, Streamflow forecasting, Historic floods, Flood frequency, Flood stages, Peak discharge, Flow characteristics, Stage-discharge relations, Flood plains, Standard Project Flood, Non-structural alternatives, Planning, Zoning, Control structures, *Mill Run(PA), Blair County(PA), Altoona(PA), Intermediate Regional Flood.

The study area involves the City of Altoona and portions of Blair County, Pennsylvania that are subject to flooding by Mill Run. The flood plain is mostly developed within Altoona. Flooding along the upper reaches of Mill Run within the city is obtained from topographic maps, historical sources, field studies, and analysis of similar watersheds in the same geographic region. Stream gage records are not available. The worst known flood occurred on March 18, 1936. Spring is the main flood season, although flooding does occur at other times. At the mouth of Mill Run the estimated peak discharge of the Intermediate Regional Flood (IRF) is 5,500 cubic feet per second (cfs), while the Standard Project Flood (SPF) would discharge 13,200 cfs. The SPF profile ranges from one to six feet higher than the IRF. The estimates of the IRF and SPF magnitudes are based on storms and floods on watersheds in the region whose topography, land cover, and physical characteristics are similar to those of Mill Run. This report is intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)
W78-02624

FLOOD PLAIN INFORMATION: LUZERNE COUNTY, PENNSYLVANIA, SUSQUEHANNA AND LACKAWANNA RIVERS.
Army Engineer District, Baltimore, MD.
Prepared for Luzerne County Planning Commission, June 1974, 109 p, 9 fig, 29 plates, 9 tab.

Descriptors: *Pennsylvania, *Historic floods, *Flood data, *Peak discharge, Floods, Flood flow, Indirect flood measurement, Streamflow forecasting, Flood profiles, Storms, Flood stages, Flood peak, Flow duration, Stage-discharge relations, Flood plains, Flood damage, Standard Project Flood, Flood protection, Non-structural alternatives, Warning systems, Land use, Planning, Zoning, Control structures, Levee, Dams, Reservoirs, Luzerne County(PA), *Susquehanna River(PA), *Lackawanna River(PA), Wilkes-Barre(PA), Intermediate Regional Flood.

The study area involves the area subject to flooding by the Susquehanna and Lackawanna Rivers in Luzerne County, Pennsylvania, covering 44 miles of the Susquehanna River and 2.5 miles of the Lackawanna River. The major city in the county is Wilkes-Barre, located on a broad flood plain. In non-urban areas, the flood plain is mostly undeveloped. Small urban areas have moderate flood plain development, while the flood plain in Wilkes-Barre is mostly developed. There are 6 flood control reservoirs upstream of Luzerne County which help to reduce flood flows. Two other reservoirs are planned. There is a system of levees in part of the study area, designed to protect the most highly developed areas from all but extremely severe floods. Flood data were obtained from topographic maps, historical sources, field studies, and stream gage records. The main flood season is late winter and early spring, and results from heavy rainfall and snowmelt. Intense rainfall at other times of year has caused some of the worst known floods. The largest flood recorded at the Wilkes-Barre gage resulted from tropical storm Agnes and occurred on June 24, 1972, cresting at 552.7 feet mean sea level (msl) and discharging 345,000 cubic feet per second (cfs). At the same location, the Intermediate Regional Flood would crest at 545.7 feet msl and would discharge 240,000 cfs, while the Standard Project Flood would crest at 558.6 feet msl and would discharge 440,000 cfs. On the Lackawanna River at Duryea, the greatest flood occurred in August 1955, cresting at 566.2 feet msl and discharging 31,000 cfs. Historic and future flood profiles are presented for the entire study area. This report is intended for use in making land use planning and management decisions regarding flood plain utilization. (Nessa-NC)
W78-02627

FLOOD HAZARD INFORMATION: CHAMBERS CREEK, EVERMAN, TEXAS.
Army Engineer District, Fort Worth, TX.
Prepared for City of Everman, TX, October 1973, 16 p, 1 fig, 6 plates.

Descriptors: *Texas, *Flood forecasting, *Flood data, *Flood recurrence interval, *Non-structural alternatives, Floods, Flood flow, Indirect flood measurement, Streamflow forecasting, Storms, Historic floods, Flood stages, Peak discharge, Stage-discharge relations, Flood damage, Flood plains, Standard Project Flood, Flood protection, Flood plain zoning, Flood plain insurance, Warning systems, Building codes, Land use, Planning, Zoning, Everman(TX), *Chambers Creek(TX), Flood plain management, 100-year flood.

The study area includes those portions of Everman, Texas affected by flooding from Chambers Creek. Some residential and industrial developments exist on the flood plain. Flood data were obtained from topographic maps, precipitation records, and similar nearby watersheds. No stream gage data exist for Everman Creek. Recent damaging floods occurred in 1952 and 1969. Flooding may occur at any time of year and results from heavy general rains or intense local thunderstorms. At the creek's mouth, the 100-year flood is expected to discharge 11,100 cubic feet per second (cfs) while the Standard Project Flood (SPF) will discharge 14,000 cfs. These flood waters will not cause significant damage until reaching the developed portions of Everman. The report discusses flood plain management techniques and describes alternative nonstructural control measures, such as flood plain zoning, subdivision regulations, flood insurance, and full or partial purchase of development rights. The data contained in this report are intended for use in making land use planning and management decisions concerning flood plain utilization. A channel modification plan for portions of Chambers Creek and the North and South Forks of Chambers Creek has been formulated as a result of this study, although the project had not been undertaken at the time the report was prepared. (Nessa-NC)
W78-02628

FLOOD PLAIN INFORMATION: CIENEGAS CREEK AND CANTU BRANCH, DEL RIO, TEXAS.
Army Engineer District, Fort Worth, TX.

Prepared for City of Del Rio, TX, May 1975, 30 p, 6 fig, 10 plates, 6 tab.

Descriptors: *Texas, *Floods, *Flood forecasting, *Flood data, *Flood recurrence interval, *Peak discharge, *Flood protection, *Non-structural alternatives, Flood flow, Indirect flood measurement, Streamflow forecasting, Storms, Historic floods, Flood frequency, Flood stages, Stage-discharge relations, Flood damage, Standard Project Flood, Flood plain zoning, Warning systems, Building codes, Land use, Planning, Zoning, Control structures, Floodproofing, Del Rio(TX), *Cienegas Creek(TX), Cantu Branch(TX), Intermediate Regional Flood, Flood plain management.

The study area encompasses about 12.5 miles of channel and includes the flood plains of Cienegas Creek and Cantu Branch in the vicinity of Del Rio, Texas. Most of the watershed is undeveloped outside of the lower reaches of Cantu Branch. Flood data were obtained from intermittent stream gage records on Cienegas Creek, topographic maps and field studies. Most flooding occurs in the spring and fall and results from heavy general rain or intense local thunderstorms. Because of the short period the stream gage was operational, only two large floods are recorded. The worst flood of record on Cienegas Creek occurred in 1935 and produced a peak discharge of 11,300 cubic feet per second (cfs). On Cienegas Creek, the Intermediate Regional Flood (IRF) is expected to discharge 20,400 cfs, cresting 11.2 feet above flood stage, while the Standard Project Flood (SPF) will discharge 36,500 cfs and will crest 13.6 feet above flood stage. On Cantu Branch, the IRF will discharge 9,100 cfs, cresting 6.0 feet above flood stage, while the SPF will discharge 14,900 cfs and will crest 6.5 feet above flood stage. Guidelines for flood plain management, and flood plain management tools are discussed. The data contained in this report are intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)
W78-02629

FLOOD PLAIN INFORMATION: MARYS AND SOUTH MARYS CREEKS, FORT WORTH, TEXAS.
Army Engineer District, Fort Worth, TX.
Prepared for City of Fort Worth, TX, May 1975, 34 p, 6 tab.

Descriptors: *Texas, *Floods, *Flood forecasting, *Flood data, *Flood recurrence interval, *Flood protection, *Non-structural alternatives, Flood flow, Indirect flood measurement, Streamflow forecasting, Flood profiles, Historic floods, Flood frequency, Flood stages, Peak discharge, Stage-discharge relations, Flood damage, Flood plains, Flood plain zoning, Flood plain insurance, Warning systems, Building codes, Land use, Planning, Floodproofing, Standard Project Flood, *Marys Creek(TX), *South Marys Creek(TX), Fort Worth(TX), Intermediate Regional Flood, Parker County(TX), Tarrant County(TX), Flood plain management.

The study area encompasses about 18.3 miles of channel and includes the portions of Parker and Tarrant Counties, Texas, and the city of Fort Worth that are affected by flooding from Marys and South Marys Creeks. The lower portions of Marys Creek contain residential and commercial areas, and the South Marys Creek flood plain contains scattered development. There are a number of manmade obstructions to flood flows in the study area. Flood data were obtained from topographic maps, field surveys, and stream gage data from similar nearby streams. No stream gage records are available for the study area streams. Most flooding occurs in the spring or fall and results from heavy general rainfall or intense local thunderstorms. The worst known floods occurred in 1949 and 1961. On Marys Creek, the Intermediate Regional Flood (IRF) is expected to discharge 36,500 cubic feet per second (cfs), cresting 6.2 feet above flood stage, while the Standard Project Flood (SPF) will discharge 62,200 cfs and crest 9.5 feet above flood stage. On South Marys Creek, the peak IRF discharge will be 11,100 cfs, cresting 4.3 feet above flood stage, while the SPF will discharge 17,000 cfs and crest 6.2 feet above flood stage. Guidelines for flood plain management, including flood plain management tools, are presented. The data contained in this report are intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)
W78-02630

FLOOD PLAIN INFORMATION: MONAHANS DRAW, ODESSA, TEXAS.
Army Engineer District, Fort Worth, TX.
Prepared for City of Odessa, TX, December 1975, 35 p, 8 fig, 17 plates, 6 tab.

Descriptors: *Texas, *Streamflow forecasting, *Flood data, *Flood recurrence interval, Floods, Flood flow, Indirect flood measurement, Flood forecasting, Storms, Historic floods, Flood stages, Peak discharge, Flow duration, Stage-discharge relations, Flood damage, Flood plains, Flood protection, Non-structural alternatives, Warning systems, Land use, Planning, Control structures, Odessa(TX), *Monahans Draw(TX), 100-year flood, 500-year flood.

The study area encompasses about 13.8 miles of channel and includes the portions of Monahans Draw in the vicinity of Odessa, Texas. The flood plain is mostly rural, sparsely populated, and contains large areas of open space. Flood data were obtained from topographic maps, field studies, precipitation records, and stream gage data from a similar nearby stream. There are no gaging stations on Monahans Draw. Most flooding occurs in the spring and early summer, and results from heavy general rain or intense local thunderstorms. The worst flood of record occurred in July 1936. No historical stream gage data exists for Monahans Draw. The peak 100-year flood discharge under averaged maximum conditions at river mile 44.43 is expected to be 17,500 cubic feet per second (cfs) and will crest 11.0 feet above flood stage, while the 500-year flood will discharge 31,000 cfs and crest 14.0 feet above flood stage. Most flood damages in the past have been to railroad and highway bridges. Large future floods may also affect residential, commercial and industrial structures. The data contained in this report are intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)
W78-02631

SPECIAL FLOOD HAZARD INFORMATION: WALNUT BRANCH, SEGUIN, TEXAS.
Army Engineer District, Fort Worth, TX.
Prepared for City of Seguin, TX, December 1975, 17 p, 1 fig, 2 plates, 2 tab.

Descriptors: *Texas, *Indirect flood measurement, *Flood forecasting, *Flood data, *Flood recurrence interval, *Non-structural alternatives, Floods, Flood flow, Streamflow forecasting, Storms, Historic floods, Flood stages, Peak discharge, Stage-discharge relations, Flood plains, Flood protection, Flood plain zoning, Flood plain insurance, Warning systems, Building codes, Land use, Planning, Control structures, *Walnut Branch(TX), Seguin(TX), Guadalupe County(TX), Flood plain management, Intermediate Regional Flood.

The study area includes the portions of the town of Seguin and Guadalupe Co., Texas, affected by flooding from Walnut Branch. Flood data were obtained from topographic maps, field studies and U.S. Geological Survey stream gage records. Flooding may occur at any time of year and results from heavy general rains or intense thunderstorms. Little historical flood information is available. The worst recent flood occurred in May 1972. At the Interstate Highway 10 bridge, the Intermediate Regional Flood is expected to discharge 6,300 cubic feet per second (cfs), cresting at 545.9 feet, mean sea level (msl). A flood of this magnitude will not damage the undeveloped upper portion of the flood plain, but will be a hazard to the more developed downstream flood plain. Guidelines for flood plain management are discussed, including structural and non-structural flood control measures. The data contained in this report are intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)
W78-02632

FLOOD PLAIN INFORMATION: CRUMP CREEK, HANOVER COUNTY, VIRGINIA.
Army Engineer District, Norfolk, VA.
Prepared for Hanover County, Virginia, March 1976, 23 p, 6 fig, 14 plates, 6 tab.

Descriptors: *Virginia, *Flood data, *Flood recurrence interval, *Non-structural alternatives, *Flood forecasting, Floods, Flood flow, Streamflow forecasting, Storms, Historic floods, Flood stages, Peak discharge, Flood peak, Flow duration, Stage-discharge relations, Flood damage, Flood plains, Flood protection, Land use, Planning, *Crump Creek(VA), Hanover County(VA), 100-year flood, 500-year flood.

The study area includes the main stream and flood plain on either side of Crump Creek in Hanover County, Virginia. The flood plain is undeveloped and mostly wooded. The projected county population growth rate of 4.5 percent will generate increasing land development pressures on the flood plain. Flood data were obtained from topographic maps, field studies, precipitation records and stream gage data from a similar nearby stream. There are no stream gaging stations on Crump Creek. Flooding may occur at any time of year, and results from heavy general rainfall or intense local thunderstorms. The worst known flood occurred in August 1955. On this date, flood waters of a similar nearby creek crested 8.62 feet above flood stage and discharged 748 cubic feet per second (cfs). At the mouth of Crump Creek, the 100-year flood is expected to discharge 10,100 cfs and crest 6.1 feet above flood stage, while the 500-year flood will discharge 16,600 cfs and crest 7.5 feet above flood stage. These floods would affect some residential properties, roads, and utilities. Considerable damage to these facilites is anticipated. The data contained in this report are intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)
W78-02633

FLOOD PLAIN INFORMATION: JAMES RIVER AT RICHMOND, VA.
Army Engineer District, Norfolk, VA.
Prepared for Richmond, VA, September 1965, 12 p, 1 plate.

Descriptors: *Virginia, *Flood data, *Flood recurrence interval, *Flood protection, *Non-structural alternatives, Floods, Flooding, Flood flow, Historic floods, Flood frequency, Flood stages, Standard Project Flood, Flood plain zoning, Warning systems, Building codes, Land use, Planning, Levee, Dikes, Floodproofing, *James River(VA), Richmond(VA).

The study are includes the portion of the James River within the city limits of Richmond, Virginia. The flood plain is completely developed. The information contained in this report is based on data found in the supplementary Technical Appendix dated September 1965. Flooding results from heavy general rainfall. Eight bridges cause obstructions to flood flows. Five would be inundated during the Standard Project Flood. The worst flood of record occured in March 1936. The main

flood problem is associated with residential flooding. The most seious flood threat is to the water treatment plant. Non-structural flood control measures also exist. Since the flood plain is already developed, these measures will limit or control future use of flood plain lands. Information is presented regarding methods to reduce future flood damages. These include flood proofing and regulatory measures such as zoning, building codes, and filling restriction. This report is designed to provide information necessary to reduce future flood damages on the heavily developed flood plain. (Nessa-NC)
W78-02634

FLOOD PLAIN INFORMATION: MECHUMPS CREEK, HANOVER COUNTY, VA.
Army Engineer District, Norfolk, VA.
Prepared for Hanover County, VA, May 1976, 25 p, 5 fig, 14 plates, 6 tab.

Descriptors: *Floods, *Flood forecasting, *Flood data, *Flood recurrence interval, Flood flow, Indirect flood measurement, Streamflow forecasting, Flood profiles, Storms, Historic floods, Flood stages, Peak discharge, Flood damage, Flood plains, Flood protection, Non-structural alternatives, Land use, Planning, *Virginia, Flood frequency, Hanover County(VA), *Mechumps Creek(VA), 500-year flood, 100-year flood.

The study area includes the main stream and flood plain on either side of Mechumps Creek in Hanover County, VA. The watershed is approximately 7.2 miles long and 3.4 miles wide at its broadest point. The flood plain is undeveloped and mostly wooded. The projected county population growth rate of 4.5 percent will generate increased land development pressure on the flood plain. There are no stream gaging stations on Mechumps Creek; however, flood data were obtained from a gaging station on Totopotomy Creek (a similar nearby stream), precipitation records, topographic maps, and field studies. Flooding may occur at any time of year, and results from heavy general rainfall or intense local thunderstorms. One railroad crossing creates obstruction to flood flow in the study area. There are no existing flood control structures. The worst known flood occurred in August 1955. On this date, at the Totopotomy Creek gage, flood waters crested at 8.62 feet above flood stage and discharged 748 cubic feet per second (cfs). At the mouth of Mechumps Creek, the 100 year flood is expected to discharge 10,800 cfs and crest 9.7 feet above flood stage, while the 500 year flood will discharge 18,000 cfs and crest 10.7 feet above flood stage. These floods would affect some residential properties, roads, and utilities. Considerable damage to these facilities is anticipated. The data contained in this report are intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)
W78-02635

FLOOD PLAIN INFORMATION: SWIFT CREEK, CHESTERFIELD COUNTY, VA.
Army Engineer District, Norfolk, VA.
Prepared for Chesterfield County, VA, July 1974, 27 p, 25 fig, 22 plates, 8 tab.

Descriptors: *Floods, *Flood forecasting, *Flood data, *Flood recurrence interval, *Peak discharge, Flood flow, Indirect flood measurement, Streamflow forecasting, Storms, Hurricanes, Historic floods, Flood frequency, Flood stages, Stage-discharge relations, Flood damage, Flood plains, Standard Project Flood, Flood protection, Land use, Planning, *Virginia, *Swift Creek(VA), Chesterfield County(VA), Colonial Heights(VA), Intermediate Regional Flood.

The study are includes the main stream and flood plain on either side of Swift Creek in Chesterfield County, Va. The flood plain consists mostly of wooded or open land. The study area consists of 30 miles along Swift Creek. Most development is located in and around the town of Colonial Heights. The projected county population growth rate of 5.9 percent will generate increasing land development pressures on the flood plain. Flood data were obtained from topographic maps, field studies, precipitation records and stream gage data from similar nearby streams and from a gage on Swift Creek maintained from 1944-49. Flooding may occur at any time of year and results from heavy general rainfall or intense local thunderstorms. The worst known flood occurred in July 1945. On this data, flood waters at the Swift Creek gage crested 29.0 feet above flood stage and discharged 13,200 cubic feet per second (cfs). Other large floods have occurred seven times between then and 1972. At the Bradley Bridge station, the Intermediate Regional Flood will crest 6.6 feet above flood stage and discharge 27,400 cfs, while the Standard Project Flood will crest 12.6 feet above flood stage and discharge 49,400 cfs. These floods would affect commercial and residential properties, roads, utilities, and all bridges except one. Considerable damage to these facilities is anticipated. The data contained in this report are intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)
W78-02636

FLOOD PLAIN INFORMATION: TOTOPOTOMOY CREEK, HANOVER COUNTY, VA.
Army Engineer District, Norfolk, VA.
Prepared for Hanover County, VA, July 1976, 28 p, 8 fig, 17 plates, 6 tab.

Descriptors: *Floods, *Flood forecasting, *Flood data, *Flood recurrence interval, Flood flow, Indirect flood measurement, Historic floods, Flood frequency, Flood stages, Peak discharge, Stage-discharge relations, Flood damage, Flood plains, Standard Project Flood, Flood protection, Non-structural alternatives, Land use, Planning, *Virginia, Streamflow forecasting, *Totopotomoy Creek(VA), Hanover County(VA), Intermediate Regional Flood.

The study area includes the mainstream and flood plain on either side of Totopotomoy Creek in Hanover County, VA, from Pamunkey River upstream to State Route 656, a distance of 15.9 miles. The flood plain is undeveloped and mostly wooded. The projected county population growth rate of 4.5 percent will generate increasing land development pressures on the flood plain. Flood data were obtained from the State Water Control Board stream gage, topographic maps, field studies and precipitation records. Flooding may occur at any time of year and results from heavy general rainfall or intense local thunderstorms. Several bridges and culverts obstruct floodflow in the study area. There are not existing flood control sturctures. The worst known flood occurred in August 1955. On this date, flood waters at the stream gage crested 8.62 feet above flood state and discharged 748 cubic feet per second (cfs). At the same location, the Intermediate Regional Flood is expected to crest 11.8 feet above flood stage, discharging 6,607 cfs. These floods would affect some residential properties, roads, and utilities. Considerable damage to these facilities is anticipated. The data contained in this report are intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)
W78-02637

FLOOD PLAIN INFORMATION: MONONGAHELA RIVER, CARROLL TOWNSHIP, DONORA, AND FALLOWFIELD TOWNSHIP, WASHINGTON COUNTY, PENNSYLVANIA.
Army Engineer District, Pittsburgh, PA.
Prepared for Washington County Planning Commission, PA, November 1970, 37 p, 2 fig, 10 plates, 6 tab.

Descriptors: *Pennsylvania, *Flood profiles, *Peak discharge, *Flood data, Floods, Flood flow, Indirect flood measurement, Flood forecasting, Storms, Historic floods, Flood stages, Flow duration, Stage-discharge relations, Flood plains, Standard Project Flood, Flood protection, Non-structural alternatives, Warning systems, Land use, Planning, Control structures, Locks, Dams, Reservoirs, *Monongahela River(PA), Donora(PA), Fallowfield Township(PA), Carroll Township(PA), Washington County(PA), Intermediate Regional Flood.

The study area includes the Monongahela River and its adjacent flood plain in Carroll and Fallowfield Townships and Donora Borough, Washington County, Pennsylvania. The flood plain is mostly developed with residential, commercial, and industrial land uses, although some land remains open. The Tygart Dam and Reservoir, WV, provides major reductions to flood flows on the Monongahela River. Locks and Dam 3, located below the study area and operated only for navigation purposes, controls all the pool in the report reach. Flood data were obtained from topographic maps, historical sources, stream gage records and field studies. The main flood season occurs from December through March and results from heavy rain and snowmelt. Heavy local rainfall may cause flooding at other times. The worst flood of record measured at Donora occurred on March 7, 1967, cresting at 753.4 feet mean sea level (msl) and discharging 158,000 cubic feet per second (cfs). The Intermediate Regional Flood (IRF) would crest at 756.0 feet msl and would discharge 182,500 cfs, while the Standard Project Flood (SPF) would crest at 759.4 feet msl and discrhage 214,000 cfs. These floods are expected to cause relatively light damage. This report is intended for use in making land use planning and management decisions concerning flood plain utilizaton. (Nessa-NC)
W78-02638

FLOOD PLAIN INFORMATION: MONONGAHELA RIVER, CENTERVILLE BOROUGH AND EAST BETHLEHEM TOWNSHIP, WASHINGTON COUNTY, PA.
Army Engineer District, Pittsburgh, PA.
Prepared for Washington County Planning Commission, PA, November 1970, 39 p, 6 fig, 13 plates, 6 tab.

Descriptors: *Pennsylvania, *Flood profiles, *Flood data, *Peak discharge, Floods, Indirect flood measurement, Flood forecasting, Storms, Historic floods, Flood stages, Flow duration, Stage-discharge relations, Flood plains, Standard Project Flood, Flood protection, Non-structural alternatives, Warning systems, Land use, Planning, Control structures, Locks, Dams, Reservoirs, *Monongahela River(PA), Centerville(PA), East Bethlehem Township(PA), Washington County(PA), Intermediate Regional Flood.

The study area involves those areas subject to flooding by the Monongahela River in Centerville Borough and East Bethlehem Township, Washington County, Pennsylvania. The flood plain is partially developed with residential and commercial land uses, and partially undeveloped. Tygart Dam and Reservoir, WV, operated by the U.S. Corps of Engineers, effectively reduce major flood crests by an average of 4 feet in the study reach. Two other flood control dams have been authorized for construction. Flood data were obtained from topographic maps, historical sources, precipitation and stream gage records, and field studies. The main flood season occurs from December through March and results from heavy rain and snowmelt. Heavy local rainfall may cause flooding at other times. The worst flood of record measured at the Maxwell Locks and Dam occurred on March 7, 1967, cresting at 38.2 feet and discharging 158,000 cubic feet per second (cfs). At the same location, the Intermediate Regional Flood (IRF) would crest about 2.5 to 3.5 feet higher than the March 1967

flood and would discharge 181,000 cfs, while the Standard Project Flood (SPF) would crest about 6.7 feet higher than the March 1967 flood and would discharge 213,000 cfs. Future floods are expected to have lower crests in spite of higher volumes due to structurally modified replacement dams. This report is intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)
W78-02639

FLOOD PLAIN INFORMATION: MONONGAHELA RIVER, FAYETTE COUNTY, PENNSYLVANIA.
Army Engineer District, Pittsburgh, PA.
Prepared for Fayette County Planning Commission, August 1973, 39 p, 13 fig, 14 plates, 8 tab.

Descriptors: *Pennsylvania, *Indirect flood measurement, *Flood data, *Stage-discharge relations, Floods, Flood flow, Flood forecasting, Flood profiles, Storms, Historic floods, Flood stages, Peak discharge, Flood plains, Standard Project Flood, Flood protection, Non-structural alternatives, Warning systems, Land use, Planning, Control structures, Locks, Dams, Reservoirs, Fayette County(PA), *Monongahela River(PA), Belle Vernon(PA), Fayette City(PA), Newell(PA), Point Marion(PA), Intermediate Regional Flood.

The study area includes the land subject to flooding by the Monongahela River in Fayette County, Pennsylvania, including the Boroughs of Belle Vernon, Fayette City, Newell, and Point Marion--a 48 mile reach of the river. The flood plain is mostly undeveloped, except in the urban places where is contains some institutional, residential, and industrial structures. Four locks and dams regulate normal flows for navigation. Tygart Lake, WV, is a flood control dam and reservoir which is effective in reducing flood crests at Brownsville by 2-4 feet. Two additional flood control dams have been authorized. When completed, they will help reduce major floods by an additional 6 feet or more. The main flood season is from December through March and results from heavy rain and snowmelt. Intense rainfall at othe times of year has caused some of the area's worst known floods. Flood data were obtained from topographic maps, historical sources, field studies and stream gage records. The worst flood recorded at the Maxwell Locks and Dam occurred on March 7, 1967, cresting at 772.7 feet mean sea level (msl) and discharging 158,000 cubic feet per second (cfs). At the same location, the Intermediate Regional Flood (IRF) would crest at 775.5 feet msl and would discharge 181,000 cfs, while the Standard Project Flood (SPF) would crest at 779.0 feet msl and would discharge 213,500 cfs. This report is intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)
W78-02640

FLOOD PLAIN INFORMATION: MONONGAHELA RIVER, MONESSEN AND ROSTRAVER TOWNSHIP, WESTMORELAND COUNTY, PENNSYLVANIA.
Army Engineer District, Pittsburgh, PA.
Prepared for Westmoreland County Planning Commission, June 1971, 43 p, 6 fig, 10 plates, 6 tab.

Descriptors: *Pennsylvania, *Regional flood, *Flood data, *Peak discharge, *Stage-discharge relations, *Flood plains, Floods, Flood flow, Indirect flood measurement, Streamflow forecasting, Flood profiles, Storms, Historic floods, Flood frequency, Flood stages, Standard Project Flood, Flood protection, Non-structural alternatives, Warning systems, Planning, Zoning, Control structures, Locks, Dams, Reservoirs, Monessen(PA), Rostraver Township(PA), Westmoreland County(PA), *Monongahela River(PA), Intermediate Regional Flood.

The study area includes the portions of the City of Monessen and Rostraver Township in Westmoreland County, Pennsylvania that are subject to flooding from the Monongahela River. Most of the flood plan is developed with residential, commercial, transportation and industrial land uses. Locks and dams on the river are operated for navigational purposes only. Tygart Lake, near Grafton, WV, is operated by the Corps of Engineers: flood impoundment reduces major flood peaks by an average of 2-4 feet. Two additional flood control structures have been authorized for construction and should enable flood peaks to be reduced an additional 4-6 feet. Flood data were obtained from topographic maps, historical sources, field studies, and stream gage records. The main flood season occurs from December through March and results from heavy rain and snowmelt. Intense rainfall at other times of year has caused some of the area's worst known floods. The largest flood recorded at Lock and Dam 4 occurred on March 7, 1967, discharging 158,000 cubic feet per second (cfs) and cresting at 756.6 feet mean sea level (msl, while the Standard Project Flood (SPF) would discharge 214,000 cfs and would crest at 763 feet msl. The modification of Dam 4 in 1967 has increased the flood containing capacity of the River. This report is intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)
W78-02641

FLOOD PLAIN INFORMATION: MONONGAHELA RIVER, UNION TOWNSHIP, NEW EAGLE, AND MONONGAHELA, WASHINGTON COUNTY, PA.
Army Engineer District, Pittsburgh, PA.
Prepared for Washington County Planning Commission, November 1970, 37 p, 5 fig, 12 plates, 6 tab.

Descriptors: *Pennsylvania, *Indirect flood measurement, *Flood profiles, *Flood data, *Flood protection, Floods, Flood flow, Storms, Streamflow forecasting, Historic floods, Flood stages, Peak discharge, Stage-discharge relations, Flood plains, Non-structural alternatives, Warning systems, Land use, Planning, Control structures, Locks, Dams, Reservoirs, *Monongahela River(PA), Union Township(PA), New Eagle(PA), Monongahela(PA), Washington County(PA).

The study area includes the Monongahela River and its adjacent flood plain in Union Township, New Eagle Borough and the City of Monongahela in Washington County, Pennsylvania. This report covers 8.3 miles from Union Township to Monongahela. The flood plain is mostly developed with residential, commercial, and industrial land uses, althougih some land remains open. One dam is located in the study area, and is used for navigation purposes only. Tygart Dam and Reservoir, WV, operated by the Corps of Engineers since 1936, effectively reduces flood peaks in the study area by an average of 4 feet. Flood data were obtained from topographic maps, historical sources, precipitation and stream gage records, and field studies. The main flood season occurs from December through March and results from heavy rain and snowmelt. Intense rainfall at other times of year has caused some of the area's worst known floods. The largest flood of record since completion of the Tygart River Dam, measured at Lock and Dam 3, occurred on October 16, 1954, cresting at 746.4 feet mean sea level (msl) and discharging 141,000 cubic feet per second (cfs). At the same location, the Intermediate Regional Flood (IRF) would crest at 747.6 feet msl and would discharge 182,500 cfs, while the Standard Project Flood (SPF) would crest at 752.4 feet msl and would discharge 214,000 cfs. Damages resulting from a recurrence of major known floods, the SPF, or the IRF would be substantial. This report is intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)
W78-02642

FLOOD PLAIN INFORMATION: NESHANNOCK CREEK BASIN, LAWRENCE COUNTY, PENNSYLVANIA--MAIN REPORT AND TECHNICAL APPENDIX.
Army Engineer District, Pittsburgh, PA.
Prepared for Lawrence Regional Planning Commission, April 1964, 44 p, 24 plates, 5 tab.

Descriptors: *Pennsylvania, *Indirect flood measurement, *Flood data, *Peak discharge, Floods, Flood flow, Streamflow forecasting, River forecasting, Flood profiles, Historic floods, Flood stages, Flow characteristics, Flood plains, Standard Project Flood, Flood protection, Non-structural alternatives, Flood plain zoning, Land use, Planning, Zoning, Control structures, Dikes, Floodwalls, Dams, Reservoirs, Channel improvement, Lawrence County(PA), *Neshannock Creek(PA), New Castle(PA), Flood plain management.

The study area involves the portions of Lawrence County, Pennsylvania that are subject to flooding from Neshannock Creek. Included are the Borough of Volant, the Townships of Hickory, Neshannock and Wilmington, and the City of New Castle. The flood plain in New Castle is entirely developed, while the rest of the flood plain is sparsely developed. Flood data were obtained from topographic maps, field studies, historical sources and precipitation. No continuous stream gage records are available prior to 1961. The main flood season occurs from December through April and results from heavy general rainfall combined with snowmelt or intense local thunderstorms. The worst known flood, as measured in New Castle, occurred on January 22, 1959, cresting at 808.4 feet mean sea level (msl). At the same location, the Standard Project Flood would crest approximately 6.5 feet higher than the 1959 flood and would discharge approximately 33,500 cubic feet per second (cfs). Guidelines for reducing future flood damages are presented, including structural and non-structural flood control measures and a discussion of flood plain management. This report is intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)
W78-02643

FLOOD PLAIN INFORMATION: OHIO AND BEAVER RIVERS, BEAVER COUNTY, PENNSYLVANIA.
Army Engineer District, Pittsburgh, PA.
Prepared for Beaver County Planning Commission, March 1973, 48 p, 11 fig, 20 plates, 11 tab.

Descriptors: *Pennsylvania, *Indirect flood measurement, *Historic floods, *Flood data, *Flood stages, *Flood protection, *Control structures, Floods, Regional flood, Flood flow, Flood forecasting, Flood profiles, Peak discharge, Stage-discharge relations, Flood plains, Standard Project Flood, Non-structural alternatives, Planning, Zoning, Locks, Dams, Reservoirs, Beaver County(PA), *Ohio River(PA), *Beaver River(PA), Intermediate Regional Flood.

The study area involves the portions of Beaver County, Pennsylvania that are subject to flooding from the Ohio and Beaver Rivers. Developments in the flood plains consist mostly of industrial and transportation land uses. There are 10 flood control projects on the Ohio River above its confluence with the Beaver River, and an additional 4 flood control projects on Beaver River, operated by the Corps of Engineers, that are effective in reducing flood levels by an average of 5-8 feet on the Ohio River above the Beaver River, and an additional 1-2 feet on the Ohio River below its confluence with the Beaver River. Flood data were obtained from topographic maps, historical sources, field studies, and stream gage records. The main flood season occurs from December through April and results from heavy rainfall combined with snowmelt. Intense rainfall at other times of year has caused floods of considerable

magnitude. The worst known flood measured at the Montgomery Locks and Dam on the Ohio River occurred on March 19, 1936, cresting at 707.6 feet mean sea level (msl) and discharging 565,000 cubic feet per second (cfs). This flood's crest would have been reduced 10.4 feeet if existing flood control structures had been in place. At the same location, the Intermediate Regional Flood (IRF) would crest at 698.6 feet msl and would discharge 408,000 cfs. On Beaver River the worst recent flood occurred in January 1959, cresting at 741.90 feet msl, and discharging 70,100 cfs. The IRF is expected to have a peak discharge of 97,000 cfs and the SPF a discharge of 137,000 cfs, cresting at 744.4 and 747.3 feet msl, respectively. Historic and future flood profiles are presented for the entire study area. This report is intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)
W78-02644

AQUATIC VASCULAR PLANTS OF THE SANDUSKY RIVER BASIN,
Ohio State Univ., Columbus. Dept. of Botany.
For primary bibliographic entry see Field 5G.
W78-02650

PLANNING FOR URBAN STORMWATER CONTROL, (PART III),
Fell, Brusso, Bruton and Knowles, Inc., Tulsa, OK.
For primary bibliographic entry see Field 5G.
W78-02660

RELATIONSHIP OF REGROWTH OF AQUATIC MACROPHYTES AFTER TREATMENT WITH HERBICIDES TO WATER QUALITY AND PHYTOPLANKTON POPULATIONS,
Florida State Game and Fresh Water Fish Commission, Eustis.
For primary bibliographic entry see Field 5G.
W78-02676

AQUATIC HERBICIDE CHRONICITY,
Creative Biology Lab., Inc., Barberton, OH.
For primary bibliographic entry see Field 5G.
W78-02677

4B. Groundwater Management

EXTRACTION OF GEOTHERMAL ENERGY BY TWO-LOOP SYSTEMS,
Krzhizhanovskii Energeticheskii Inst., Moscow (USSR).
For primary bibliographic entry see Field 8C.
W78-02276

SOLAR IRRIGATION SYSTEM BEGINS OPERATION IN NEBRASKA.
For primary bibliographic entry see Field 3F.
W78-02279

GEOTHERMAL HEAT: TO WHAT EXTENT CAN IT SATISFY OUR ENERGY HUNGER,
H. C. H. Armstead.
Chartered Mechanical Engineer, Vol. 24, No. 6, p 66-69, June, 1977.

Descriptors: *Energy, *Geothermal studies, *Natural resources, *Conservation, Heat transfer, Fuels, Hydroelectric power, Thermal waters, Fractures(Geology), Drilling, *Energy consumption, Hydraulic fracturing, Impact-fracturing, Hot dry rock, *Geothermal heat.

In spite of the growth of nuclear and hydroelectric power in the past few years, the world is still very dependent upon fossil fuels to satisfy energy needs. Estimates vary on the extent of the earth's untapped fossil fuels, but even at the highest estimate the life of ultimate fossil fuel reserves will be very short if growth of energy consumption per capita increases at the rate it has in the recent past. Geothermal energy now contributes only a very small portion of the world's energy, but potential for further development is great. Compared with hyperthermal fields (capable of yielding high heat suitable for power generation) and semi-thermal fields (providing warm water suitable for space heating), 'hot dry rock' areas are fairly widely scattered across the world; advances in drilling techniques which would permit penetration to 13 or 14 km into the earth's crust would provide even greater access to subterranean heat sources. Research on new deep drilling methods, especially rock melting, is essential in order that existing heat extraction technology can be applied to energy production. (Eberle-NWWA)
W78-02280

GEOTHERMAL DEVELOPMENT OF THE SALTON SEA,
DSS Engineers, Inc., Ft. Lauderdale, FL.
For primary bibliographic entry see Field 3E.
W78-02281

POWER FROM HOT GEOTHERMAL BRINES,
Rotoflow Corp., Los Angeles, CA.
For primary bibliographic entry see Field 8C.
W78-02282

PROVINCIAL DRILLING METHODS IN BANGLADESH: PART I,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 8B.
W78-02286

THE POTENTIAL FOR GEOTHERMAL STEAM,
Union Oil Co. of California, Los Angeles.
C. Otte.
Chemical Engineering Progress, Vol. 72, No. 7, p 80-82, July, 1976. 2 fig, 1 tab.

Descriptors: *Geothermal studies, *Thermal power plants, Thermal power, Electric power, Heated water, Steam, Geysers, Hot springs, Heated water, Water temperature, Corrosion, Fatigue, Brines, Drilling, The Geysers, Dry rock technology, Geopressured systems, Tectonic margins.

Molten magma near the surface produces high temperature zones at shallow depths along tectonic plate margins. Nearby ground water or water of crystallization will flash into steam when drilled wells release the overlying pressure. Steam or hot water can be converted to electricity or used in industrial process applications. The Geysers north of San Fransico has the world's largest installed capacity: 520,000 kW. Hard rocks typical of potential sites make drilling difficult. Corrosive hot saline brines and gases make well completion and development difficult. Geothermal wells cost 50% more than comparable oil wells. The low quality heat produced must be used locally or converted to electricity. Although not necessarily cheaper than fossil fuels, geothermal energy can be effective from smaller units. Geothermal potential may exist for 20 million kW with utilization of low-temperature deposits and development of geopressured systems and dry rock technology, thus reducing utilities' demand and foreign imports of fossil fuels. (Palmer-NWWA)
W78-02288

ALTERNATE MATERIALS OF CONSTRUCTION FOR GEOTHERMAL APPLICATIONS,
Brookhaven National Lab., Upton, NY. Dept. of Applied Science.
For primary bibliographic entry see Field 8G.
W78-02290

GEOTHERMAL ENERGY: ITS PROMISE FOR THE FUTURE.
For primary bibliographic entry see Field 3E.
W78-02294

NEBRASKA STUDIES WAYS TO RECHARGE AQUIFER STORAGE,
Universal Oil Products, St. Paul, MN. Johnson Div.
A. Smith.
Johnson Drillers Journal, Vol. 49, No. 5, p 1-3, September-October, 1977. 1 fig.

Descriptors: *Irrigation wells, *Artificial recharge, *Water table, Pumping, Well screens, Drawdown, Water wells, Logging(Recording), *Old West Regional Commission, *Nebraska.

The importance of recharge studies to the national ground water situation is being demonstrated by current research in Nebraska. The problem of declining water levels in that state is so severe that the future of continued ground water use for irrigation in some regions depends largely on the results of injection well studies now being made in Hamilton County between Aurora and Grand Island. This project is being sponsored by the Old West Regional Commission and conducted by the Nebraska Water Resources Center and the USGS. The experimental system consists of a withdrawal well located three miles west of an injection well; observation wells continuously monitor changes in aquifer levels as injection proceeds. In both the injection and the withdrawal wells, electric logs were valuable in accurately locating aquifer zones of best producing and recharge potential. The Nebraska study is only a part of a wide-ranging Old West Regional Commission artificial recharge project which includes Montana, North and South Dakota, and Wyoming as well. (Eberle-NWWA)
W78-02295

GROUND WATER QUALITY MODEL OF THE CHIPUXET AQUIFER IN THE UPPER PAWCATUCK RIVER BASIN,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W78-02402

NITROGEN SOURCE DIFFERENTIATION THROUGH CARBON ISOTOPES,
Nebraska Univ., Lincoln. Conservation and Survey Div.
For primary bibliographic entry see Field 5B.
W78-02406

GROUND WATER FAVORABILITY AND SURFICIAL GEOLOGY OF THE PORTLAND AREA, MAINE,
Geological Survey, Augusta, ME. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02413

WATER RESOURCES DATA FOR TENNESSEE, WATER YEAR 1976.
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02417

WATER RESOURCES DATA FOR WISCONSIN WATER YEAR 1976.
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02418

WATER RESOURCES DATA FOR NEW MEXICO, WATER YEAR 1976.
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02419

WATER RESOURCES DATA FOR NEW HAMPSHIRE AND VERMONT, WATER YEAR 1976.
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02420

WATER RESOURCES IN WESTERN CORTLAND COUNTY, NEW YORK: HYDROLOGIC DATA FOR 1972-75 AND PROGRESS REPORT,
Geological Survey, Ithaca, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02422

SOLUTION OF THREE-DIMENSIONAL GROUND-WATER FLOW EQUATIONS USING THE STRONGLY IMPLICIT PROCEDURE,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W78-02428

GROUND-WATER DATA FOR THE DREWSEY RESOURCE AREA, HARNEY AND MALHEUR COUNTIES, OREGON,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02430

SALINE-WATER INTRUSION RELATED TO WELL CONSTRUCTION IN LEE COUNTY, FLORIDA,
For primary bibliographic entry see Field 5B.
W78-02434

PARTIALLY-SATURATED TRANSIENT GROUNDWATER FLOW MODEL THEORY AND NUMERICAL IMPLEMENTATION,
Montana Univ., Missoula. Dept. of Water and Land Resources.
For primary bibliographic entry see Field 2G.
W78-02453

INVESTIGATIONS OF THE DUNES GEOTHERMAL ANOMALY, IMPERIAL VALLEY, CALIFORNIA: PART 1, GEOCHEMISTRY OF GEOTHERMAL FLUIDS,
California Univ., Riverside. Inst. of Geophysics and Planetary Physics.
For primary bibliographic entry see Field 2F.
W78-02535

INVESTIGATIONS OF THE DUNES ANOMALY, IMPERIAL VALLEY, CALIFORNIA: PART II, PETROLOGICAL STUDIES,
California Univ., Riverside. Dept. of Earth Sciences.
For primary bibliographic entry see Field 2F.
W78-02536

THE REPORT TO CONGRESS: WASTE DISPOSAL PRACTICES AND THEIR EFFECTS ON GROUND WATER.
Environmental Protection Agency, Washington, DC. Office of Water Supply.
For primary bibliographic entry see Field 5E.
W78-02537

DEEP WELL INJECTION OF INDUSTRIAL WASTES: GOVERNMENT CONTROLS AND LEGAL CONSTRAINTS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 5G.
W78-02538

SIMILARITY SOLUTIONS FOR CONVECTION OF GROUNDWATER ADJACENT TO HORIZONTAL IMPERMEABLE SURFACES WITH AXISYMMETRIC TEMPERATURE DISTRIBUTION
Hawaii Univ., Honolulu. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 2F.
W78-02539

HYDRAULIC FRACTURE EXPERIMENTS IN GT-1 AND GT-2,
Los Alamos Scientific Lab., NM.
For primary bibliographic entry see Field 8E.
W78-02540

NEW SOURCES OF ENERGY: PROCEEDINGS OF THE CONFERENCE, VOLS. 2 AND 3, GEOTHERMAL ENERGY.
United Nations, New York.
Proceedings of the United Nations Conference on New Sources of Energy, August 21-30, 1961, Rome, Italy. UN Publication No. E/CONF. 35/3 and E/CONF. 35/4. 936 p, 362 fig, 125 tab, 327 ref, 3 append.

Descriptors: *Thermal power, *Geothermal studies, Thermal powerplants, Electric power production, Subsurface investigations, Surveys, Geophysics, Geochemistry, Thermal waters, Steam, Drilling, Wells, Drill holes, Equipment, Well casings, Generators, Japan, Italy, New Zealand, Mexico, Central America, Iceland, United States.

The Proceedings of the United Nations Conference on New Sources of Energy comprise seven volumes, two volumes of which are entirely devoted to reports on geothermal resources and technology. Geological assessments are presented for many potential power sites throughout the world. A great deal of material is also devoted to techniques and equipment for the drilling and power production phases of geothermal development. Volume I of the collected geothermal papers (Vol. II of the Proceedings) concentrates on geothermal prospecting while Volume II (Volume III of the Proceedings) deals with the mechanics of thermal energy utilization. The Conference Rapporteur's general report and his summation of the proceedings in connection with the agenda item are given in full in both English and French, as are those papers that were submitted to the Conference in both languages. With a few exceptions, all the papers are summarized in both English and French. (Eberle-NWWA)
W78-02541

GOVERNING EQUATIONS FOR GEOTHERMAL RESERVOIRS,
Systems, Science and Software, La Jolla, CA.
For primary bibliographic entry see Field 2F.
W78-02542

LABORATORY TESTS OF RELIEF WELL FILTERS: REPORT 1, WELLS ALONG THE MISSISSIPPI RIVER LEVEES, ALTON TO GALE, ILLINOIS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 8B.
W78-02545

MONITORING GROUNDWATER QUALITY,
Environmental Protection Agency, Las Vegas, NV. Office of Research and Development.
For primary bibliographic entry see Field 5A.
W78-02547

COMBINED BIOLOGICAL TREATMENT AND UNDERGROUND INJECTION OF REFINERY WASTE WATER,
Energy Research and Development Administration, Bartlesville, OK. Bartlesville Energy Research Center.
For primary bibliographic entry see Field 5D.
W78-02548

RESERVOIR EVALUATION TESTS ON RRGE 1 AND RRGE 2, RAFT RIVER GEOTHERMAL PROJECT, IDAHO,
California Univ., Berkeley. Lawrence Berkeley Lab.
T. N. Narasimhan, and P. A. Witherspoon.
Available from the National Technical Information Service, Springfield, VA 22161 as LBL 5958, Price codes: A04 in paper copy, A01 in microfiche. Publication No. LBL-5958, May, 1977. 50 p, 18 fig, 3 tab, 3 ref, 3 append.

Descriptors: *Geothermal studies, *Wells, Thermal water, Reservoirs, Sedimentary rocks, Water pressure, Pressure head, Pressure measuring instruments, Artesian wells, On-site investigations, Water yield, Boundaries(Surfaces), Gravity, Drawdown, Idaho, *Raft River Valley(Idaho), Well interference, Earth tides.

The successful geothermal wells RRGE 1 and RRGE 2, have indicated that a geothermal reservoir exists in the Raft River Valley with a producing horizon 1000 feet thick and a temperature of 146 degrees C. Three hydraulic tests were conducted to estimate the production parameters of the reservoir. The primary task of these tests was the careful and accurate measurement of water pressure changes in the wells, facilitated by the use of a highly sensitive quartz pressure gauge. Results indicate that the reservoir is extensive and significantly permeable. It therefore merits further exploration. It also appears that the reservoir is bounded in some direction, although the data from two wells was insufficient to precisely locate the boundary. The Raft River Valley reservoir was found to respond systematically to the small changes in the earth's gravitational field induced by the paths of the sun and the moon; appropriate corrections had to be made for these earth tide effects before one could interpret the pressure transient data for the reservoir production parameters. (Eberle-NWWA)
W78-02549

CONCEPTUAL DESIGN OF COMMERCIAL 50 MWE (NET) GEOTHERMAL POWER PLANTS AT HEBER AND NILAND, CALIFORNIA.
Bechtel International Corp., San Francisco, CA.
For primary bibliographic entry see Field 8C.
W78-02550

ESTIMATING AQUIFER PERMEABILITY BY SURFACE ELECTRICAL RESISTIVITY MEASUREMENTS,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2F.
W78-02551

TWO-DIMENSIONAL SIMULATION OF THE RAFT RIVER GEOTHERMAL RESERVOIR AND WELLS,
EG and G Idaho, Inc., Idaho Falls.
W. C. Kettenacker.
Available from the National Technical Information Service, Springfield, VA 22161 as TREE 1085, Price codes: A06 in paper copy, A01 in

microfiche. ERDA Report No. TREE-1085, March, 1977. 96 p, 13 fig, 4 tab, 29 ref, 4 append.

Descriptors: *Geothermal studies, *Computer models, *Thermal water, *Wells, Reservoirs, Heat transfer, Pressure, Temperature, Model studies, Thermal power, Idaho, *Raft River Geothermal Project (Idaho), Finite-difference models.

The objective of the work was to develop the tools necessary for long-term predictions of the response of the Raft River Valley geothermal reservoir and the wells drilled there in conjunction with the Raft River Valley Geothermal Project. A finite-difference computer code was the tool chosen. This code was based on the SINDA-36 computer program, an n-dimensional thermal analyzer which uses an electrical network (capacitor-conductor) analogy and a lumped parameter (node) representation of the physical system to solve steady-state and transient problems. Models describing both the transient reservoir pressure behavior and the time dependent temperature response of the wells have been developed. Vertical, two-dimensional, finite-difference, axisymmetric models for each of the three existing wells at Raft River were also constructed to describe the transient temperature and hydraulic behavior in the vicinity of the wells. The models are solved simultaneously with one input deck so that reservoir-well interaction may occur. Predicted results agree favorably with the test data obtained. (Eberle-NWWA)
W78-02552

GEOTHERMAL RESOURCES, EXPLORATION AND EXPLOITATION: A BIBLIOGRAPHY.
Department of Energy, Oak Ridge, TN. Technical Information Center.
For primary bibliographic entry see Field 8B.
W78-02553

PROVINCIAL DRILLING METHODS IN BANGLADESH: PART II,
National Water Well Association, Worthington, OH.
J. A. Hunt.
Water Well Journal, Vol. 32, No. 1, p 85-87, January, 1978. 2 fig.

Descriptors: *Drilling, Water wells, Irrigation wells, Equipment, Aquifers, Labor, Costs, *Bangladesh, *Manual well drilling methods, Manual percussion drilling, Manual jetting, Hollow rod drilling.

Twenty wells recently constructed in Bangladesh under the auspices of the Joint Christian Catholic Irrigation Project were drilled using three manual methods. The manual percussion method consists of standing heavy-wall, flush-jointed casing on end and then bailing out the earth inside it by using a sludger with a flap valve at the bottom. Drilling action is accomplished by a number of men bouncing their weight on a taut cable. A second technique, the manual jetting method, utilizes direct circulation of drilling mud through standard 3-inch galvanized pipe. Rotation of the bit is achieved by attaching chain tongs to the drill pipes and having men walk around in a circle, pushing the tong handles. A third method, known as hollow rod drilling can be used for very small holes in favorable formations. Although these manual methods involve low capital cost and employ much unskilled labor, cost per foot of drilling is high and transportation of heavy materials can sometimes be a problem. These methods should still continue to have a place in Bangladesh, however, as utilization of power rigs is nearly impossible in many parts of that country. (Eberle-NWWA)
W78-02554

GROUND-WATER CONTAMINATION: PROBLEMS AND REMEDIAL ACTIONS,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 5B.
W78-02675

4C. Effects On Water Of Man's Non-Water Activities

RUNOFF FROM SOFTWOOD PLOTS THAT HAVE BEEN THINNED AND CLEARCUT,
Mississippi Univ., University. Dept. of Geology and Geological Engineering.
K. J. Banaszak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 598, Price codes: A03 in paper copy, A01 in microfiche. Mississippi State University, Water Resources Research Institute, Completion Report, October 1977. 21 p, 5 fig, 3 tab, 14 ref. OWRT A-102-MISS(1), 14-34-0001-7052.

Descriptors: *Forest management, Storm runoff, Water quality, *Clear-cutting, *Nutrients, Loblolly pine trees, *Mississippi, Water pollution sources, *Dissolved solids, Phosphates, Nitrates, Sodium, Potassium, Calcium, Ammonia, Silicates, Tannens, Lignins.

Loblolly pine plantings on three east-west trending redges in north-central Mississippi were used to study the output of dissolved constituents (PO4, NO3, NH4, Na, K, Ca, SiO2, and tannins plus lignins) from control, thinned, and clearcut plots. Each treatment was performed on the north-facing and south-facing slope. The data from each of the three treatments of north-facing slopes were compared first with matching treatments of south-facing slopes, and no significant difference in the quantity of dissolved output was noted. The runoff from control plots did show significant differences in quality, with total PO4 and Ca higher from north-facing slopes at the 99.9% confidence level (C.L. = 99.9). The concentrations of total PO4 and dissolved SiO2 in runoff were different for the three treatments (C.L.=99.)), with the highest values from the clearcuts. The concentration of K in runoff, highest from control plots, also was significantly different (C.L.=99.9) for all ridges. Analysis of the quantity of output of constituents indicated that only PO4 had a difference above the 95% confidence level. This study indicates that (1) phosphate is the nutrient that should be of most concern to forestry practice in the Southeastern United States and (2) measurements of quantity and quality of nutrient loss may give different results with regard to statistical significance.
W78-02204

SOME ECONOMIC AND ENVIRONMENTAL EFFECTS OF HIGHWAYS IN JAPAN AND THE UNITED STATES,
Federal Highway Administration, Washington, D.C. Transportation Economics Div.
For primary bibliographic entry see Field 5C.
W78-02221

URBAN STORM RUNOFF INLET HYDROGRAPH STUDY: VOL. 1, COMPUTER ANALYSIS OF RUNOFF FROM URBAN HIGHWAY WATERSHEDS UNDER TIME-AND SPACE-VARYING RAINSTORMS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 4D.
W78-02240

URBAN STORM RUNOFF INLET HYDROGRAPH STUDY: VOL. 2, LABORATORY STUDIES OF THE RESISTANCE COEFFICIENT FOR SHEET FLOWS OVER NATURAL TURF SURFACES,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 4D.
W78-02241

URBAN STORM RUNOFF INLET HYDROGRAPH STUDY: VOL. 3, HYDROLOGIC DATA FOR TWO URBAN HIGHWAY WATERSHEDS IN THE SALT LAKE CITY AREA, UTAH,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 4D.
W78-02242

URBAN STORM RUNOFF INLET HYDROGRAPH STUDY: VOL. 5, SOIL-COVER-MOISTURE COMPLEX: ANALYSIS OF PARAMETRIC INFILTRATION MODELS FOR HIGHWAY SIDESLOPES,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 4D.
W78-02244

AQUATIC ORGANISMS FROM SELECTED SITES ALONG THE TRANS-ALASKA PIPELINE CORRIDOR, SEPTEMBER 1970 TO SEPTEMBER 1972 - SUPPLEMENT,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 5C.
W78-02437

A SOCIAL AND ECONOMIC IMPACT STUDY OF OFFSHORE PETROLEUM AND NATURAL GAS DEVELOPMENT IN ALASKA. PHASE II.
Mathematical Sciences Northwest, Inc., Bellevue, WA.
For primary bibliographic entry see Field 5G.
W78-02517

AIR AND WATER CONTAMINATION BY 3,4-BENZPYRENE FROM ROAD ABRASION, (IN GERMAN),
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Hygiene und Arbeitsphysiologie.
For primary bibliographic entry see Field 5A.
W78-02562

4D. Watershed Protection

INVENTORY OF SEDIMENT SAMPLE COLLECTION STATIONS IN THE MISSISSIPPI RIVER BASIN,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Mobility and Environmental Systems Lab.
For primary bibliographic entry see Field 2J.
W78-02230

URBAN STORM RUNOFF INLET HYDROGRAPH STUDY: VOL. 1, COMPUTER ANALYSIS OF RUNOFF FROM URBAN HIGHWAY WATERSHEDS UNDER TIME-AND SPACE-VARYING RAINSTORMS,
Utah Water Research Lab., Logan.
C. L. Chen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 985, Price codes: A12 in paper copy, A01 in microfiche. Report FHWA-RD-76-116, March 1976. 269 p, 37 fig, 4 tab, 123 ref, 4 append. DOT-FH-11-7806.

Descriptors: *Urban runoff, *Highways, *Utah, *Model studies, Mathematical models, Computer models, Runoff, Rainfall, Storms, Storm runoff, Storm water, Cities, Watersheds(Basins), Hydrographs, Flood routing, Analytical techniques, Hydrology, *Salt Lake City(Utah).

The main objective of this study was to develop an accurate design method for computing inlet hydrographs of surface runoff, with average recurrence intervals of 10, 25, and 50 years, from typical urban highway by flood routing technique. The most comprehensive mathematical model based on the method of characteristics was developed

for computing the runoff inlet hydrograph. All flood routing methods were reviewed extensively, and the most efficient and accurate technique was adopted for the formulation of a numerical (computer) model, including all the rainfall-runoff processes on a highway watershed. Accuracy of the computer model was examined by comparing the computed inlet hydrographs with field data obtained both from the Corps of Engineers airfield experiments and from typical highway cross sections in the Salt Lake City area. A few exploratory computer experiments indicated that the development of a unified dimensionless inlet hydrograph or a family of such hydrographs for typical highway cross sections seems possible. An appendix contained the computer program listing for the model. (See W78-02241 thru W78-02244) (Sims-ISWS)
W78-02240

URBAN STORM RUNOFF INLET HYDROGRAPH STUDY: VOL. 2, LABORATORY STUDIES OF THE RESISTANCE COEFFICIENT FOR SHEET FLOWS OVER NATURAL TURF SURFACES,
Utah Water Research Lab., Logan.
C. L. Chen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 986, Price codes: A06 in paper copy, A01 in microfiche. Report FHWA-RD-76-117, March 1976. 104 p, 29 fig, 17 tab, 48 ref, 1 append. DOT-FH-11-7806.

Descriptors: *Sheet flow, *Turf grasses, *Laboratory tests, Rainfall simulators, Flow resistance, Friction, Fluid friction, Flow friction, Roughness(Hydraulic), Surface runoff, Research facilities, Flow, Vegetation, Hydraulics, Hydrology.

The main objective of this study was to develop an accurate design method for computing inlet hydrographs of surface runoff, with average recurrence intervals of 10, 25, and 50 years, from typical urban highway by flood routing technique. Resistance to sheet flows over natural turf surfaces was investigated experimentally. The formulation of a functional relationship between the resistance coefficient and controlling parameters for shallow flows over various turf surfaces is essential to the mathematical modeling of surface runoff from urban highway sideslopes covered with different species of turf. An analysis of results obtained from laboratory experiments for laminar flow on Kentucky Blue grass and Bermuda grass revealed that a relationship exists between the Darcy-Weisbach friction coefficient, Reynolds number, and bed slope. Time did not permit tests to be performed on all species of turf other than Kentucky Blue grass and Bermuda grass which can be sodded. However, a general trend of the resistance relationship for shallow flows over such dense turf surfaces as affected by raindrop impact and roughness was determined qualitatively. (See also W78-02240) (Sims-ISWS)
W78-02241

URBAN STORM RUNOFF INLET HYDROGRAPH STUDY: VOL. 3, HYDROLOGIC DATA FOR TWO URBAN HIGHWAY WATERSHEDS IN THE SALT LAKE CITY AREA, UTAH,
Utah Water Research Lab., Logan.
J. E. Fletcher, and C. L. Chen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 987, Price codes: A06 in paper copy, A01 in microfiche. Report FHWA-RD-76-118, March 1976. 113 p, 40 fig, 16 tab, 3 ref. DOT-FH-11-7806.

Descriptors: *Urban runoff, *Highways, *On-site data collections, *Utah, Rainfall, Precipitation(Atmospheric), Storms, Storm runoff, Runoff, Weirs, Temperature, Air temperature, Winds, Watersheds(Basins), Soil moisture, Infiltration, Hyetographs, Hydrographs, On-site investigations, Hydrology, *Salt Lake City(Utah).

The main objective of this study was to develop an accurate design method for computing inlet hydrographs of surface runoff, with average recurrence intervals of 10, 25, and 50 years, from typical urban highway by flood routing technique. Hydrologic data, such as the rainfall intensity, runoff flow rate, air temperature, wind velocity, and soil moisture content, were collected during rainfall seasons in 1972 and 1973 on two urban highway watersheds in the Salt Lake City area, Utah. The data were used in the verfication of a mathematical model simulating the surface runoff from such highway watersheds. The difficulties and inherent problems associated with field data collection from urban highway cross section were discussed, and possible remedies were recommended. Hyetographs and the corresponding hydrographs of major storms which occurred in 1972 and 1973 at both sites were presented. Watershed infiltration capacities of sideslopes at both sites were evaluated empirically. (See also W78-02240) (Sims-ISWS)
W78-02242

URBAN STORM RUNOFF INLET HYDROGRAPH STUDY: VOL. 4, SYNTHETIC STORMS FOR DESIGN OF URBAN HIGHWAY DRAINAGE FACILITIES,
Utah Water Research Lab., Logan.
C. L. Chen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 988, Price codes: A08 in paper copy, A01 in microfiche. Report FHWA-RD-76-119, March 1976. 170 p, 20 fig, 183 tab, 55 ref, 5 append. DOT-FH-11-7806.

Descriptors: *Rainfall, *Runoff, *Design storm, Model studies, Mathematical models, Storms, Cities, Highways, Frequency, Equations, Drainage, Design, Rainfall intensity, Hyetographs, Hydrology, Climatology, Intensity-duration curves.

The main objective of this study was to develop an accurate design method for computing inlet hydrographs of surface runoff, with average recurrence intervals of 10, 25, and 50 years, from typical urban highway by flood routing technique. Knowledge of the time distribution of rainfall in heavy storms constitutes a basis for the design of an urban storm sewer system. A unified time-coordinate system and the rainfall intensity-duration-frequency relationships were used to develop the generalized synthetic (design) hyetograph equations for all types of storms. The hyetograph equations were normalized further for identifying the dimensionless parameters that play predominant roles in the formulation of a design storm pattern. The method of least squares and an optimization technique were applied to the evaluation of the storm parameters through the use of the rainfall intensity-duration-frequency maps in the U.S. Weather Bureau Technical Paper No. 40. It was found that the parameter evaluation method can be simplified greatly by establishing relationships among the storm parameters. However, an analysis of available actual hyetographs failed to establish any relationships between the storm skewness and the other storm parameters. (See also W78-02240) (Sims-ISWS)
W78-02243

URBAN STORM RUNOFF INLET HYDROGRAPH STUDY: VOL. 5, SOIL-COVER-MOISTURE COMPLEX: ANALYSIS OF PARAMETRIC INFILTRATION MODELS FOR HIGHWAY SIDESLOPES,
Utah Water Research Lab., Logan.
C. L. Chen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 989, Price codes: A09 in paper copy, A01 in microfiche. Report FHWA-RD-76-120, March 1976. 182 p, 33 fig, 20 tab, 165 ref, 2 append. DOT-FH-11-7806.

Descriptors: *Infiltration, *Highways, *Runoff, *Utah, *Model studies, Mathematical models, Equations, Soil groups, Soil classification, Soil properties, Soils, Soil moisture, Grasses, Turf, Slopes, Cities, Laboratory tests, Storm runoff, Rainfall, Hydrology, Highway sideslopes.

The main objective of this study was to develop an accurate design method for computing inlet hydrographs of surface runoff, with average recurrence intervals of 10, 25, and 50 years, from typical urban highway by flood routing technique. The boundary-value problem of one-dimensional infiltration resulting from rainfall was formulated and solved numerically on a digital computer. The numerical solution of this idealized mathematical model was used as a basic testing tool in the subsequent analysis of various parametric infiltration models, including the Green-Ampt, Kostiakov, Philip, Horton, and Holtan equations. The time of ponding was shown to be the most important parameter in a parametric infiltration model and can be expressed in terms of other parameters in the model as well as the rainfall intensity. The values of all the model parameters were determined to be fairly constant for a soil having the same initial and upper boundary (soil surface) conditions. Use of the Green-Ampt, Kostiakov, and Philip type models for the prediction of the infiltration rate before and after ponding was proved to be satisfactory. For engineering practice, the standard infiltration-capacity curves for soil-civer-moisture complexes representing urban highway sideslopes were developed empirically based on the unique selection of the Soil Conservation Service Runoff curve number. Validity of typical standard curves so developed was examined experimentally in the Utah Water Research Laboratory stormflow experiment facility. (See also W78-02240) (Sims-ISWS)
W78-02244

EXPERIMENTAL STUDY OF DRAINAGE BASIN EVOLUTION AND ITS HYDROLOGIC IMPLICATIONS,
Colorado State Univ., Fort Collins.
R. S. Parker.
Colorado State University Hydrology Paper No. 90, June 1977. 57 p, 54 fig, 23 tab, 88 ref, 2 append.

Descriptors: *Drainage density, *Model studies, *Geomorphology, *Land forming, *Erosion, Hydrographs, Rainfall intensity, Peak discharge, Topography, Hydrology, Sediment yield, Overland flow, *Drainage basin evolution, Nonlinear response, Erosional evolution.

An experimental study was conducted to document the evolution of the drainage system on an initially flat, gently sloping surface under 4 intensities of rainfall on a 9 by 15 m facility. The relief and initial surface slope were varied from one experiment to the other. Basin evolution can be studied from a plot of drainage density through time, which shows an increase to a maximum at maximum extension followed by a decline during abstraction. Sediment yields from the basin undergoing erosional evolution show an exponential decline with time. The overall trend is characterized by high variability. Hydrographs generated on various geomorphic surfaces as evolution progressed suggested that runoff produced by lower precipitation intensities is most influenced by the geomorphology of the basin. The basin produced an increasingly nonlinear response as drainage density decreased. This may result from greater overland flow as drainage density decreases. The efficiency of the hydrologic response, as indexed by the peak of the instantaneous unit hydrograph, appears to increase to a maximum as drainage density and/or relief increases. (Singh-ISWS)
W78-02262

HYDROLOGIC CONSIDERATIONS ASSOCIATED WITH DREDGING SPRING PONDS IN WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.

W. J. Rose.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 508, Price codes: A03 in paper copy, A01 in microfiche. Water-Resources Investigations 77-18, June 1977. 35 p, 14 fig, 1 plate, 3 tab, 5 ref.

Descriptors: *Dredging, Effects, *Inflow, *Ponds, *Wisconsin, Groundwater movement, Springs, Water level fluctuations, Lake sediments, Hydrogeology, *Lake restoration.

Spring ponds (small spring-fed bodies of water) are natural features of some glaciated areas. The purpose of this study was to determine the hydrology of three spring ponds in northeastern Wisconsin and the effects that dredging has had on the ponds. Sediments were dredged from Sunshine and Krause Ponds. Maxwell Pond, which was not dredged, was used as a hydrologic control. Sediment accumulation since glaciation caused a 2-fold reduction in the surface area of Sunshine Pond and a 4-fold reduction in the area of Krause Pond. Volume reduction caused by sediment accumulation was 9-fold in Sunshine Pond and 28-fold in Krause Pond. Dredging 4.2 acre-feet of sediment from Sunshine Pond caused a 41-percent increase in ground-water inflow. Dredging 4.0 acre-feet of sediments from Krause Pond caused only a 2-percent increase in ground-water inflow. (Woodard-USGS)
W78-02421

THE WELFARE EFFECTS OF EROSION CONTROLS, BANNING PESTICIDES, AND LIMITING FERTILIZER APPLICATION IN THE CORN BELT,
Texas A and M Univ., College Station. Dept. of Agricultural Economics and Rural Sociology.
For primary bibliographic entry see Field 5G.
W78-02527

CONTROLLING NONPOINT SEDIMENT SOURCES WITH CROPLAND MANAGEMENT: A NATIONAL ECONOMIC ASSESSMENT,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 5G.
W78-02568

THE SOIL MOISTURE COMPONENT OF MATHEMATICAL CATCHMENT SIMULATION MODELS,
Seven-Trent Water Authority, Birmingham (England).
For primary bibliographic entry see Field 2G.
W78-02598

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

ALPHA- AND GAMMA-BHC IN TAMAGAWA RIVER WATER, JAPAN (SEPTEMBER 1968 TO SEPTEMBER 1969),
Tokyo Metropolitan Univ. (Japan). Dept. of Chemistry.
M. Ochiai, and T. Hanya.
Environmental Pollution, Vol 11, No 3, p. 161-166, November 1976. 4 fig, 1 tab, 6 ref.

Descriptors: *Pesticides, *Insecticides, *Pesticide residues, Water pollution sources, Rivers, Chlorine, Pollutants, Water sampling, Gas chromatography, Analytical techniques, *Tamagawa River(Japan), *BHC, Organochlorine pesticides.

Residue concentrations of the organochloride pesticide BHC, which has been used in Japan for about 30 years and reached a peak of 46,830 tons in 1968, were measured in the Tamagawa River near Tokyo. Sampling was done at Hino, Noborito, and Maruko from September 1968 to September 1969. Pesticide determination was made with a Shimadzu model GC-2C gas chromatograph equipped with a H-3 foil electron capture detector. Distinguishing of alpha- from gamma-BHC was based on relative retention times to aldrin of two different columns of the gas chromatograph and the Rf values of an alumina thin layer chromatograph. Concentrations of BHC residues at Maruko ranged from 14-577 ng/l alpha-BHC; and 24-179 ng/l gamma-BHC; at Noborito 16-487 ng/l gamma-BHC. The highest concentration was at Maruko on 11 July 1969. The high for Noborito was also in July, but for Hino the high was in May. It is thought that high BHC residues in the river in summer reflect the high summer use of the pesticide. (Lynch-Wisconsin)
W78-02218

RADIUM-226, URANIUM, AND OTHER RADIOLOGICAL DATA COLLECTED FROM WATER QUALITY SURVEILLANCE STATIONS LOCATED IN THE COLORADO RIVER BASIN OF COLORADO, UTAH, NEW MEXICO, AND ARIZONA- JANUARY, 1961 THROUGH JUNE, 1972.
Environmental Protection Agency, Denver, CO. Surveillance and Analysis Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-244 920, Price codes: A12 in paper copy, A01 in microfiche. Report #SA/TIB-24, July 1973. 272 p, 29 fig, 33 tab, 1 append.

Descriptors: *Water quality, *Radioactive wastes, *Colorado River, *Colorado River Basin, Sampling, Data collections, On-site data collections, Monitoring, Pollutants, Rivers, Mining, Mine wastes, Water pollution, *Uranium, *Radium-226.

The RMN ('Radiological' or 'Radium Monitoring Network') System was established in 1961. This report presented all of the available data supplied by the RMN System to date. The report also examined certain of the data in terms of their long- and short-term trends. In excess of 3,000 measurements of radium-226 and uranium in the dissolved state were presented as are many measurements of other radioactivity parameters. The report concentrated on total uranium and radium-226 data for surface waters and compared the mean 'background' concentration with concentrations downstream of uranium mills and uranium tailings piles. Due in part to a decrease in the number of uranium mills and in part to an improvement in the caretaking of uranium tailings piles, concentrations of radium-226 and uranium total have decreased generally throughout the Basin with the notable exceptions being within the Dolores-San Miguel Rivers System clearly showed the water quality degradation caused by uranium extraction activities. This straightforward statistical analysis also serves as a basis for evaluating the radium content of other river systems. (Sims-ISWS)
W78-02231

DESIGN CONSIDERATIONS FOR SAMPLING PROGRAMS IN REMOTE AREAS,
Alaska Univ. College.
For primary bibliographic entry see Field 7A.
W78-02235

WORKSHOP REPORT ON ACID PRECIPITATION AND THE FOREST ECOSYSTEM,
Northeastern Forest Experiment Station, Delaware, OH.
L. S. Dochinger, and T. A. Seliga.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-261 813, Price codes: A02 in paper copy, A01 in microfiche. Technical Report NE-26, Northeastern Forest Experiment Station, Upper Darby, Pennsylvania, December 1976. 21 p. NSF DES75-13749.

Descriptors: *Precipitation(Atmospheric), *Air pollution, *Acids, *Forests, Powerplants, Energy, Effects, Pollutants, Sulfur compounds, Nitrogen compounds, Rainfall, Snowfall, Vegetation, Soils, Forest soils, Water pollution, Path of pollutants, *Acid precipitation.

The first International Symposium on Acid Precipitation and the Forest Ecosystem provided the first worldwide forum devoted to consideration of acid precipitation and forestry problems. The symposium brought together experts from diverse fields of the physical and biological sciences to discuss their research and their concerns about a potentially serious environmental problem. A Workshop, organized as a follow-up to the Symposium, benefited greatly from participation by more than 60 international scientists. A report on the Workshop was presented. Five discussion panels were formed to consider: (1) Atmospheric Emissions, Transport, Transformation, and Removal; (2) Effects on Aquatic Systems; (3) Effects on Forest Soils; (4) Effects on Forest Vegetation; and (5) Energy-Related Issues. The report identified the nature, extent, and dimensions of the problems associated with acid precipitation. The recommendations contained in the report should serve as a guide for research by scientists and for program planning by academic, industrial, government, and public-interest groups. (Sims-ISWS)
W78-02236

EXAMINATION OF THE ELUTRIATE TEST, A SCREENING PROCEDURE FOR DREDGING REGULATORY CRITERIA,
Canada Centre for Inland Waters, Burlington (Ontario).
V. Cheam, A. Mudroch, P. G. Sly, and K. Lum-Shue-Chan.
Journal of Great Lakes Research, Vol 2, No 2, p 272-282, December 1976. 4 fig, 2 tab, 20 ref.

Descriptors: *Dredging, *Water pollution, *Chemical analysis, Surveys, Monitoring, Spoil banks, Water pollution sources, Laboratory tests, Sediments, Pollutants, Heavy metals, Zinc, Mercury, Lead, Cadmium, Chemicals, Water quality, *Dredging regulatory criteria, Standard Elutriate Test.

Water quality parameters were considered in a series of tests, including the Standard Elutriate Test designed to appraise the elutriate techniques. Both the conditional stability constant and the complexing capacity of the elutriate were greater than those of background waters. Although the concentration of the Standard Elutriate can be greater than 1.5 times the original concentration for the four heavy metals considered (Zn, Hg, Pb, Cd), it may be still less than the standards for drinking water and freshwater or marine aquatic life. Thus, such releases themselves should not significantly affect the water quality. It appears that improvement of the existing dredging regulatory criteria concerning Hg, Pb and Zn is desirable. On the other hand, tests indicated that the release of phosphorus can be large and might significantly affect the water quality in actual open water disposal. It was suggested, therefore, that further research be performed to elucidate the behaviour of phosphorus release from dredged spoils, and that the concentrations of phosphorus and other constituents in the elutriates be compared to the standards. Finally, it was suggested that an acceptable test should realistically reflect the occurrence at the disposal site and, consequently, should at least incorporate an estimated resulting sediment-water ratio and a mixing process representative of the dump site. (Sims-ISWS)
W78-02253

PERSISTENCE OF SOME PHENYLAMIDE PESTICIDES IN THE AQUATIC ENVIRON-

MENT – II. ADSORPTION ON CLAY MINERALS,
National Research Centre, Cairo (Egypt). Water Pollution Control.
For primary bibliographic entry see Field 5B.
W78-02264

REDUCTION OF SALMONELLA, E. COLI, COLIFORMS AND FECAL STREPTOCOCCI BY CHLORINATION OF SEWAGE TREATMENT PLANT EFFLUENTS,
Rijksinstituut voor de Volksgezondheid, Bilthoven (Netherlands). Lab. voor Stralingsonderzoek.
For primary bibliographic entry see Field 5D.
W78-02325

COMPOUNDS RESISTANT TO CARBON ADSORPTION IN MUNICIPAL WASTEWATER TREATMENT,
Weyerhauser Co., Tacoma, WA.
D. K. Chow, and M. M. David.
Journal of the American Water Works Association, Vol. 69, No. 10, p 555-561, October 1977. 5 fig, 8 tab, 64 ref.

Descriptors: *Pollutant identification, *Activated carbon, *Analytical techniques, *Adsorption, Water analysis, Phenols, Heavy metals, Nitrogen compounds, Effluents, Coagulation, Molecular structure, Organic wastes, Chemical analysis, Aromatic compounds, Chlorination, Salts, Municipal wastes, Elements, Waste water treatment, Carbon adsorption resistance.

Since waste water designated for reuse may undergo tertiary treatment consisting only of activated carbon adsorption, studies were conducted to identify compounds in municipal waste water which are resistant to carbon adsorption. Primary effluents were chemically pretreated by flocculation with FeCL or alum and the clarified liquor was passed through a sand filter and a 0.45-micron membrane filter. The chemically treated primary and biologically treated secondary effluents were passed through columns of granular activated carbon, concentrated by evaporation, filtered, and recycled through the system to simulate water reuse. Resistant compounds were analyzed with TOC content measurements, ultrafiltration for molecular size distribution, neutron-activation analysis for elemental distributions, atomic adsorption for metallic elements, UV spectroscopy for organic compounds, and thermogravimetric analysis for inorganic compounds. The elemental composition indicated that Na, N, and Cl were most resistant, followed by C, K, Fe, Ca, Zn, and Mg. Molecular size distributions indicated that molecules with relatively small sizes (less than 240 nm) accounted for 45-60% of the resistant compounds while large molecules (larger than 640 nm) accounted for only 5-18% of the total carbon content. Organic compounds identified include chlorinated hydrocarbons, aliphatic acids, aromatic amines, phenolic compounds, and calcium salts of orgaic acids. The major inorganic compounds which were identified included sodium and calcium salts of chlorides, nitrates, sulfates, and phosphates. Concentrations of free cyanides and metallic elements were negligible. (Schulz-FIRL)
W78-02344

SPECTROPHOTOMETRIC DETERMINATION OF RESIDUAL HYDROGEN PEROXIDE,
Brussels Intercommunal Water Co., (Belgium).
W. Massachelein, M. Denis, and R. Ledent.
Water and Sewage Works, Vol 124, No 8, p 69-72, August, 1977. 2 fig, 34 ref.

Descriptors: *Pollutant identification, *Cobalt, *Oxidation, *Colorimetry, *Spectrophotometry, *Bicarbonates, *Analytical techniques, Chemical reactions, Water treatment, Disinfection, Chemical wastes, Waste water treatment, *Hydrogen peroxide, Analytical interference.

Hydrogen peroxide (H2O2) a strong oxidizing agent, decomposes by reactions in water and leaves residual oxygen. Applications of hydrogen peroxide in waste water treatment include oxidation of sulfhydric acid and mercaptans, indirect oxidation of phenols, aeration, disinfection in reservoirs, and elimination of taste or odor caused by chlorine or chloramines in drinking water. Various analytical methods for determining residual H2O2 concentrations are described. Existing methods include colorimetric determination with titanium(IV) salt (chloride or sulfate), with phenolphthalein in the presence of Cu(+2), or with oxygen-sensitive electrodes which have been adapted for use with H2O2 by incorporating a suitable catalyst (MnO2, Co2O3, or Ru2O3) in the electrode membranes. The cobalt-bicarbonate-H2O2 method for determination of H2O2 is described. Standard solutions containing H2O2 are titrated with ammonium molybdate and neutral potassium iodide. Sodium hexametaphosphate, Co(+2), and a saturated sodium bicarbonate solution are added to samples, producing an intense bicarbonate green color which is probably caused by the presence of a Co(+3) carbonate complex. Absorption is measured with a spectrophotometer at 260 nm. The reported detection limit is about 0.01 mg/liter H2O2 with possible interference caused by turbidity or suspended particles. A graph for optical density (absorption) as a function of H2O2 concentration is provided. (Schulz-FIRL)
W78-02367

EVALUATION OF A NITRATE-SPECIFIC ION ELECTRODE,
University of Southern California, Los Angeles. Environmental Engineering Program.
K. Y. Yu, and P. M. Berthouex.
Journal Water Pollution Control Federation, Vol 49, No 8, p 1869-1901, August, 1977. 1 fig, 9 tab, 7 ref.

Descriptors: *Pollutant identification, *Electrodes, *Analytical techniques, *Permselective membranes, *Nitrates, *Electrochemistry, Water chemistry, Aqueous solutions, Chemical properties, Chemical potential, Electric equipment, Model studies, Chemical analysis, Waste water treatment, Nitrate-specific ion electrodes, Brucine method.

The Simple Electrode and the Standard-Addition Electrode methods are used to evaluate nitrate determinations with a nitrate-specific ion electrode and the Brucine method using effluent samples from biological treatment units. The nitrate electrode measures nitrate activity in terms of potential across a layer of water-immiscible ion exchanger held in place by an inert porous membrane. Electrode behavior follows a Nernst relation within the working range. Ionic interference is usually counteracted by the addition of a buffer to maintain constant ionic strength. The Standard-Addition or Known-Increment method involves the addition of a known amount of nitrate to a solution containing an unknown amount. The quantity of nitrate present in the initial solution is determined by measuring the change in potential produced by the additional nitrate. Grab samples of waste water effluent with nitrate concentrations ranging from 2-20 mg/liter were collected from nitrification pilot plants. Higher readings obtained with the Simple Electrode method than with Standard-Addition were attributed to greater influence of high hardness and alkalinity in the waste water on simple electrode determinations. Standard errors for nitrate determinations with the Brucine method were higher than for either electrode method, and procedures were more time-consuming, requiring reagent preparation. The specific-nitrate ion electrode is recommended as a relatively inexpensive, fast, portable means of nitrate determination in waste water for concentrations as low as 1 mg/liter nitrate-N. (Schulz-FIRL)
W78-02368

OBSERVATIONS ON PRE-ENRICHMENT FOR ISOLATING SALMONELLAS FROM SEWAGE POLLUTED NATURAL WATER USING MULLER-KAUFFMANN TETRATHIONATE BROTH PREPARED WITH FRESH AND DESSICATED OX BILE,
Central Public Health Lab., Cardiff (England).
R. W. S. Harvey, and T. H. Price.
Journal of Applied Bacteriology, Vol 43, No 1, p 145-148, August, 1977. 2 tab, 13 ref.

Descriptors: *Salmonella, *Pollutant identification, *Analytical techniques, *Microbiology, *Bioassay, *Cultures, Sewage bacteria, Pollutant identification, Path of pollutants, Bacteria, Microorganisms, Water treatment, Waste water treatment, Ox bile, Muller-Kauffmann Tetrathionate Broth.

Dessicated ox bile was evaluated as a substitute for fresh bile in the preparation of Muller-Kauffmann Tetrathionate Broth for the isolation of salmonellas from sewage-polluted waters. Salmonellas in water samples collected from the Taff River in Wales were isolated in media which had been prepared with fresh bile, dessicated bile, or a combination of the two. The media had also been directly enriched or had undergone pre-enrichment followed by enrichment. Studies on enriched samples indicated that fresh bile was more efficient for isolating salmonella than dessicated bile. With pre-enrichment, both forms were equally satisfactory. (Schulz-FIRL)
W78-02370

COMPUTERS AND INSTRUMENTATION--PARTNERS IN TREATMENT PLANT OPERATION,
For primary bibliographic entry see Field 7C.
W78-02373

LEVEL INSTRUMENTATION IN EFFLUENT TREATMENT PLANTS.
Water and Pollution Control, Vol. 115, No. 9, p 29-34, September, 1977. 6 fig.

Descriptors: *Monitoring, *Analytical techniques, *Flow measurement, *Ultrasonics, *Pollutant identification, Electronic equipment, Flow control, Pumping, Waste water treatment, Tuning forks, Capacitance systems.

Analytical instrumentation and flow monitoring devices available for use in waste water treatment plants are discussed. General detection methods employed in flow measurement and control include sonic, ultrasonic, capacitance probe, vibrating probe, windlass, nuclear, microwave, and radar. Sonic and ultrasonic systems are used to provide non-contact level measurements based on reflected pulses whose echos are received by an emitting transducer located above the water surface. Sonic and ultrasonic systems such as the E + H Aquatot system can be used at various points in a sewage plant, including the in-flow points, between primary and secondary treatment facilities, and at outflow points. They can also be used for automatic bar screen control, screw pump control, and slide valve control in an activated sludge tank. Large-scale application of sonic controllers to monitor groundwater levels and control pump start-up in Richmond, British Columbia, Canada, is described. The E + H Aquatot system has also been used for open channel measurement by the city of Thompson in Manitoba, Canada. The change in electrical capacitance between a probe and the wall of a tank is used to operate capacitance systems for operation and automatic sequencing of a pumping system. The E + H tuning fork, or Vibratrol instrument, contains a piezoelectric element which is used for underwater detection. Additional applications of monitoring instruments produced by Endress and Hauser of West Germany are discussed for mechanical windlass instruments, nuclear and microwave measurement, gamma radiation,

microwave control, and other instrument types. (Schulz-FIRL)
W78-02375

APPLICATION OF THE RAPID LYSINE DECARBOXYLASE TEST FOR EARLY ISOLATION AND DETECTION OF SALMONELLAE IN SEWAGE AND OTHER WASTEWATERS,
National Environmental Engineering Research Inst., Nagpur (India). Life Sciences Div.
P. M. Phirke.
Applied and Environmental Microbiology, Vol. 34, No. 4, p 453-455, October, 1977. 1 tab, 18 ref.

Descriptors: *Salmonella, *Enteric bacteria, *Analytical techniques, *Testing procedures, *Microbiology, Bioassay, Water analysis, Sewage bacteria, Food processing industry, Municipal wastes, Waste water treatment, *Pollutant identification, *Lysine decarboxylase test, Salmonella detection, Bacteriology.

The lysine decarboxylase (LD) test has been among several test schemes advocated for identification of Enterobacteriacea and has been used in conjuction with hydrogen sulfide production to verify the presence of Salmonellae. The applicaton of the rapid lysine decarboxylase test for isolation and detection of Salmonella was evaluated in experiments with 39 waste water samples, including raw sewage, settled sewage, treated effluent from facilities at the National Environmental Engineering Research Institute in India, and raw and filtered slaughterhouse wastes. The test involved inoculation of samples into Kauffman tetrathionate broth, incubation at 41.5C for 24 or 48 hr, streaking of the enriched culture on BGA plates, and incubation of the BGA plates for 18 hr at 37C. Colonies exhibiting a pink or magenta hue were then inoculated into tubes which contained lysine broth, and sterile 0.5% plain agar was added. The tubes were incubated in a dry-air, water-jacketed unit at 37C and read at 1-, 2-, 3-, and 4-hr intervals. The development of a green blue color was considered as a positive indication of LD activity. Tests with the LD method which revealed Salmonellae presence in 129 of 205 colonies were verified with the modified Kohn method and with slide agglutination tests of 6-hr growth obtained on nutrient agar slopes. The LD test was capable of identifying and isolating Salmonellae within 2-3 days, as compared to 5-6 days with conventional methods. (Schulz-FIRL)
W78-02379

SONICATION OF ACTIVATED SLUDGE FLOCS AND THE RECOVERY OF THEIR BACTERIA ON SOLID MEDIA,
York Univ. (England). Dept. of Biology.
For primary bibliographic entry see Field 5D.
W78-02384

THE DELINEATION OF A POINT SOURCE PLUME BY THE STUDY OF BACTERIAL POPULATIONS,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W78-02392

GROUND WATER QUALITY MODEL OF THE CHIPUXET AQUIFER IN THE UPPER PAWCATUCK RIVER BASIN,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W78-02402

DETECTION OF A POTENTIAL HEALTH HAZARD IN RECREATIONAL AND OTHER SURFACE WATERS,
Nebraska Univ. at Omaha. Dept. of Biology.
W. D. O'Dell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 769, Price codes: A03 in paper copy, A01 in microfiche. Nebraska Water Resources Research Institute, Lincoln, Completion Report, September 1977. 19 p, 4 fig, 4 tab, 13 ref. OWRT A-037-NEB(1), 14-34-0001-7058.

Descriptors: *Naegleria, *Acanthamoeba, Hartmannella, Vahlkampfia, Primary amebic meningoencephalitis, *Amebas, Soils, Muds, *Pollutant identification, Biomass, Analytical techniques, Public health, Soil analysis, Water analysis, Nebraska, Protozoa, Pathogens.

A plating-method for the detection and quantification of free-living amebas from soils and water was developed and tested. This method allows reliable estimates of the populations of amebas present in environmental samples. Application of this method to sample the population of amebas from a selected lake demonstrated some seasonal variation in the populations of these organisms. One genus, Acanthamoeba, was the dominant member of the ameba community which also included the genera Naegleria, Hartmannella and Vahlkampfia. In the study, only small free-living amebas were isolated and identified. However, this method could be used in the detection of closely related pathogenic amebas with only slight modifications to determine the pathogenicity of the isolates.
W78-02405

NITROGEN SOURCE DIFFERENTIATION THROUGH CARBON ISOTOPES,
Nebraska Univ., Lincoln. Conservation and Survey Div.
For primary bibliographic entry see Field 5B.
W78-02406

WATER RESOURCES DATA FOR TENNESSEE, WATER YEAR 1976.
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02417

WATER RESOURCES DATA FOR WISCONSIN WATER YEAR 1976.
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02418

WATER RESOURCES DATA FOR NEW MEXICO, WATER YEAR 1976.
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02419

WATER RESOURCES DATA FOR NEW HAMPSHIRE AND VERMONT, WATER YEAR 1976.
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02420

WATER RESOURCES IN WESTERN CORTLAND COUNTY, NEW YORK: HYDROLOGIC DATA FOR 1972-75 AND PROGRESS REPORT,
Geological Survey, Ithaca, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02422

HYDROLOGIC RECONNAISSANCE OF THE EASTERN NORTH SLOPE, ALASKA, 1975,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 4A.
W78-02424

TIME OF TRAVEL OF SOLUTES IN MISSISSIPPI RIVER FROM BELLE CHASSE TO THE VICINITY OF HEAD OF PASSES, LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W78-02426

METHODS FOR DETERMINATION OF RADIOACTIVE SUBSTANCES IN WATER AND FLUVIAL SEDIMENTS,
Geological Survey, Lakewood, CO. Water Resources Div.; and Colorado School of Mines, Golden.
L. L. Thatcher, V. J. Janzer, and K. W. Edwards.
Available from Supt. of Documents, GPO, Washington, DC 20402. Techniques of Water-Resources Investigations, Book 5, Chapter A5, 1977. 95 p, 11 fig, 2 tab, 88 ref.

Descriptors: *Radiochemical analysis, *Analytical techniques, *Water analysis, *Fluvial sediments, *Radioactive waste disposal, Radioisotopes, Chemical analysis, Water pollution, Uranium radioisotopes, Tritium, Laboratory equipment, Lead-210, Radium-226, Radium-228, Carbon-14, Cesium-137, Strontium-90, Ruthenium-106.

Analytical methods for the determination of some of the more important components of fission or neutron activation product radioactivity and of natural radioactivity found in water and fluvial sediments are reported. The report for each analytical method includes conditions for application of the method, a summary of the method, interferences, required apparatus and reagents, analytical procedures, calculations, reporting of results, and estimation of precision. The fission product isotopes considered are cesium-137, strontium-90, and ruthenium-106. The natural radioelements and isotopes considered are uranium, lead-210, radium-226, radium-228, tritium, and carbon-14. A gross radioactivity survey method and a uranium isotope ratio method are given. When two analytical methods are in routine use for individual isotope, both methods are reported with identification of the specific areas of application of each. Techniques for the collection and preservation of water samples to be analyzed for radioactivity are discussed. (Woodard-USGS)
W78-02429

GROUND-WATER DATA FOR THE DREWSEY RESOURCE AREA, HARNEY AND MALHEUR COUNTIES, OREGON,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-02430

METHODS FOR COLLECTION AND ANALYSIS OF AQUATIC BIOLOGICAL AND MICROBIOLOGICAL SAMPLES,
Geological Survey, Reston, VA. Water Resources Div.
P. E. Greeson, T. A. Ehlke, G. A. Irwin, B. W. Lium, and K. V. Slack.
Available from the Supt. of Documents, GPO, Washington, DC 20402, Price $20.00. Geological Survey Techniques of Water-Resources Investigations, Book 5, Chapter A4, 1977. 332 p, 60 fig, 11 tab.

Descriptors: *Analytical techniques, *Aquatic populations, *Methodology, *Sampling, *Statistical methods, Enteric bacteria, Aquatic microbiology, Benthic fauna, Biomass, Chlorophyll, Preservation, Diatoms, Fish, Periphyton, Phytoplankton, Zooplankton, *Biological sampling, *Water samples, Glossary.

Book 5, chapter A4 of Techniques of Water Resources Investigations contains methods used by the U.S. Geological Survey to collect, preserve, and analyze waters to determine their biological and microbiological properties. Part 1 discusses biological sampling and sampling statistics. The statistical procedures are accompanied by examples. Part 2 consists of detailed descriptions of more than 45 individual methods, including those for bacteria, phytoplankton, zooplankton, seston, periphyton, macrophytes, benthic invertebrates, fish and other vertebrates, cellular contents, productivity, and bioassays. Each method is summarized, and the application, interferences, apparatus, reagents, collection, analysis, calculations, reporting of results, precision, and references are given. Part 3 consists of a glossary. Part 4 is a list of taxonomic references. (Woodard-USGS)
W78-02432

WATER-QUALITY STUDY OF TULPEHOCKEN CREEK, BERKS COUNTY, PENNSYLVANIA, PRIOR TO IMPOUNDMENT OF BLUE MARSH LAKE,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W78-02433

EVALUATION OF CHEMICAL, BIOLOGICAL, AND PHYSICAL CONDITIONS IN THE WINTER HAVEN CHAIN OF LAKES, FLORIDA, MARCH-JUNE 1976,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. C. Reichenbaugh, and G. H. Hughes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 027, Price codes: A03 in paper copy, A01 in microfiche. Water-Resources Investigations 77-52, July 1977. 34 p, 14 fig, 2 tab, 8 ref.

Descriptors: *Lakes, *Florida, *Water quality, *Biological properties, *Physical properties, Eutrophication, Water pollution sources, Inflow, Urban runoff, Agricultural runoff, Industrial wastes, Sewage disposal, Turbidity, Hydrogeology, Groundwater, Withdrawal, Water level fluctuations, *Winter Haven lakes(Fla), Chain of lakes.

Reconnaissance of water-quality conditions of 14 interconnected navigable lakes, in and around Winter Haven, Fla., revealed that in March and May, 1976 most were eutrophic, on the basis of high nutrient (nitrogen and phosphorus) concentrations. Lakes Lulu and Shipp were the most enriched as a result of surface runoff from residential, agricultural, and highly urbanized areas, and many years of municipal and industrial waste effluent input. Phytoplankton counts were greater than a million cells per milliliter in some lakes sampled; algal blooms have ocurred, and water clarity was low. The level of Lake Howard fell to the lowest stage recorded in 31 years during May 1976. The record low was likely due to rainfall deficiency. Leakage of water through the lake beds to the ground-water system is also possible, but determination of the escaping water volume would require additional study. (Woodard-USGS)
W78-02435

AQUATIC ORGANISMS FROM SELECTED SITES ALONG THE TRANS-ALASKA PIPELINE CORRIDOR, SEPTEMBER 1970 TO SEPTEMBER 1972 - SUPPLEMENT,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 5C.
W78-02437

ENVIRONMENTAL PHOSPHORUS HANDBOOK.
For primary bibliographic entry see Field 5B.
W78-02457

A STOCHASTIC MODEL FOR BOD AND DO IN STREAM WHEN POLLUTANTS ARE DISCHARGED OVER CONTINUOUS STRETCH,
South Carolina Univ., Columbia. Dept. of Mathematics and Computer Science.
For primary bibliographic entry see Field 5B.
W78-02458

THE HYDROGRAPHY OF THE MURDERKILL ESTUARY, DELAWARE,
Delaware Univ., Newark. Dept. of Biological Sciences.
For primary bibliographic entry see Field 2L.
W78-02459

THE ACUTE TOXICITY OF 47 INDUSTRIAL CHEMICALS TO FRESH AND SALTWATER FISHES,
Battelle Pacific Northwest Labs., Richland, WA. Water and Waste Management Section.
For primary bibliographic entry see Field 5C.
W78-02463

A METHOD OF STUDYING PHOTOSYNTHETIC CAPACITIES IN UNICELLULAR ALGAE BASED ON IN VIVO CHLOROPHYLL FLUORESCENCE,
Umea Univ. (Sweden). Dept. of Plant Physiology.
G. Samuelsson, and G. Oquist.
Physiologia Plantarum, Vol 40, No 4, p 315-319, 1977. 6 fig, 23 ref.

Descriptors: *Photosynthesis, *Fluorescence, *Algae, *Chlorophyll, Chlorophyta, *Pollutant identification, Analytical techniques, Methodology, *DCMU-induced fluorescence.

The correlation between photosynthesis and DCMU-induced fluorescence increase is studied in four species of unicellular green algae from inoculation of the cultures to the stationary growth phase. It is concluded that compared to currently available methods for measurement of photosynthetic productivity in aquatic systems, the fluorescence method would be a rapid and comparably-accurate method for obtaining information on both chlorophyll content and photosynthetic capacities for estimation of primary production capacities of algal populations. The fluorescence increase induced by DCMU was high in exponentially growing cultures but decreased when the cultures approached the stationary phase of growth. Because of good correlation between photosynthesis and DCMU-induced fluorescence increase, the fluorescence technique is considered promising. The fluorescence method has the advantage of being used for chlorophyll determination in algal samples or in natural aquatic systems without enrichment of the algal concentration through filtration. (Coyle-Wisconsin)
W78-02467

THE PROBLEM OF THE SANITARY PROGNOSIS OF THE WATER QUALITY OF THE NIZHNEKAMSK RESERVOIR, (IN RUSSIAN),
Kazan Inst. of Porsgraduate Medicine (USSR).
For primary bibliographic entry see Field 5C.
W78-02468

BASELINE LEVELS OF BENZO(A)PYRENE IN SOUTHERN CALIFORNIA MUSSELS,
British Columbia Univ., Vancouver. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W78-02472

RATES OF DIRECT PHOTOLYSIS IN AQUATIC ENVIRONMENT,
Environmental Research Lab., Athens, GA.
R. G. Zepp, and D. M. Cline.
Environmental Science and Technology Vol. 11, No. 4, April, 1977, p 359-366. 12 fig, 2 tab, 34 ref.

Descriptors: *Photoactivation, *Pollutants, *Water pollution, *Solar radiation, *Light, Equations, Seasonal, Depth, Ozone, Insecticides, Pesticides, Herbicides, Methodology, *Photolysis, *Photochemical processes, Carbaryl, Trifluralin, Direct photolysis.

A simple technique is described for computing direct photolysis rates under sunlight of aquatic pollutants. Direct photolysis, a photochemical process, involves direct absorption of light by the pollutant followed by chemical reaction. Photolysis rate refers to conversion per unit time. All photochemical process rates in a water body are affected by solar spectral irradiance at the water surface, radiative transfer from air into water, and the transmission of sunlight into the water. Computations were performed on a minicomputer. Required data inputs are: (1) molar extinction coefficients of the pollutant at wavelengths >297.5 nm; (2) attenuation coefficients and refractive index of the reaction medium; (3) quantum yields for reaction of the pollutant; (4) solar declination, solar right ascension, and sidereal time; (5) latitude and longitude; and (6) average ozone layer thickness. Equations are derived that describe the direct photolysis rates of pollutants, and translate laboratory data into photolysis half-lives. As an illustration, photolysis rates are computed for carbaryl, a carbamate insecticide, and trifluralin, a pre-emergent herbicide. Limitations of the computations include: (1) full sunlight and sea level are assumed; (2) rates are computed on average ozone amounts; (3) natural organics in a water body are assumed to be photo-chemically inert; (4) light scattering is ignored; and (5) the pollutant is assumed to be isotropically distributed. (Lynch-Wisconsin)
W78-02474

FLUORINE CONTENTS AND MINERALIZATION LEVEL OF DRINKING WATERS IN THE PROVINCE OF MACERATA, (IN ITALIAN),
Camerino Univ. (Italy). Ist. di Igiene.
M. Cocchioni, M. G. Pellegrini, and F. Tarantini.
Ig Mod 69(6), p 448-460, 1976.

Descriptors: *Fluorine, *Potable water, Italy, *Pollutant identification, Mineralogy.

The F content and the level of mineralization of the drinking waters (man, animals) in the province of Macerata (Italy) were given. In all the samples examined, a notable lack of F was discovered which became more marked further away from the coast line.--Copyright 1978, Biological Abstracts, Inc.
W78-02480

A CYTOCHEMICAL AND BIOCHEMICAL INDEX OF STRESS IN MYTILUS EDULIS L.,
Institute for Marine Environmental Research, Plymouth (England).
For primary bibliographic entry see Field 5C.
W78-02489

LEAD IN PORT PHILLIP BAY MUSSELS,
La Trobe Univ., Bundoora (Australia). Dept. of Inorganic and Analytical Chemistry.
V. Talbot, R. J. Magee, and M. Hussain.
Marine Pollution Bulletin, Vol. 7, No. 12, p. 234-237, December 1976. 2 fig, 3 tab, 22 ref.

Descriptors: *Mussels, *Bioindicators, *Lead, *Cadmium, Human pathology, Water pollution sources, Bays, Oysters, Intertidal areas, Estuaries, Toxicity, *Australia, *Port Phillip Bay(Australia), *Ostrae angasi, *Corio Bay(Australia), Melbourne(Australia).

The mussel Mytilus edulis and the oyster Ostrae angasi were colledted at 22 locations in Port Phillip and Corio Bays, Australia for use as bioindicators to determine the LD50 values for lead. According to the results of the experiment, oysters concentrate lead to a lesser extent than mussels do. In addition, mussels collected from the intertidal zones of piers have a lower lead content. Lead concentrations in the bays are the highest in the vicinity of built-up areas. The highest concentrations of lead are accumulated in the mussel shell, followed by gills, stomach, and muscle tissue. The LD50 experiment also indicates that cadmium, mercury, copper and zinc are more lethal than lead to this organism. 1.5 ppm of cadmium has the same lethal effect as 30 ppm of lead. Metallothionein, the protein which absorbs toxic trace metals and render them inert, showed association with cadmium and zinc, but not with lead when isolated from mussels collected in the Corio Bay cadmium polluted areas. Since in many cases 2 ppm of cadmium in the seawater is lethal to mussels, and some Corio Bay mussels were found to have 200 ppm of cadmium, it appears that the rate of metallothionein synthesis is the key factor in determining the survival of individual mussels. (Harris-Wisconsin)
W78-02490

BIOACCUMULATION FACTORS OF CHLORINATED HYDROCARBONS BETWEEN MUSSELS AND SEAWATER,
California Univ., Bodega Bay. Bodega Marine Lab.
R. W. Risebrough, B. W. De Lappe, and T. T. Schmidt.
Marine Pollution Bulletin, Vol 7, No 12, p 225-228, December 1976. 3 fig, 1 tab, 20 ref. NSF GX-32885 and IDO72-06412A02.

Descriptors: *Mussels, *Bioindicators, *Chlorinated hydrocarbon pesticides, DDT, DDE, Polychlorinated biphenyls, Sea water, California, Pacific Ocean, *Bioaccumulation factors(Partition coefficients), Marseille, France, Mediterranean Sea, Mytilus spp., Mytilus californianus.

To determine usefulness of the mussel Mytilus spp. as a bioindicator of coastal contamination by chlorinated hydrocarbons, a study was made to measure bioaccumulation factors (partition coefficients) of PCB and DDT between the mussels and ambient seawater. Bioaccumulation factors were determined by measuring concentrations of the substances at four sites on the Mediterranean coast of France and two sites in California. Factors for PCB in mussels and seawater ranged between 69,000 in San Francisco Bay samples to 690,000 in samples from near Marsille. Corresponding ratios of concentrations of p,p'-DDE or p,p'-DDT ranged from 40,000 in the San Francisco sample to 690,000 for the Marseille sample. Bioaccumulation of electron-capturing substances, common in the ambient seawater, by mussels was much lower than the bioaccumulation of DDT and PCB compounds containing five or more chlorine atoms. Differences in the relative heights of PCB peaks in seawater and mussel chromatographs were interpreted in terms of differences in value of bioaccumlation factors of individual chlorobiphenyls. It is concluded that although mussels can be appropriate and convenient bioindicators for local hydrocarbon contamination levels, factors contributing to the variance in partition coefficients must be determined before the animals can be widely used in global monitoring programs. (Harris-Wisconsin)
W78-02491

THE RELATIONSHIP BETWEEN PHOTOSYNTHESIS AND LIGHT FOR NATURAL ASSEMBLAGES OF COASTAL MARINE PHYTOPLANKTON,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
For primary bibliographic entry see Field 5C.
W78-02495

CHRONOLOGY OF ORGANOCHLORINE COMPOUNDS IN LAKE MICHIGAN FISH, 1929-66,
Wisconsin Univ.-Madison. Dept. of Wildlife Ecology.
W. J. Neidermyer, and J. J. Hickey.
Pesticides Monitoring Journal, Vol 10, No 3, p 92-95, December 1976. 1 fig, 1 tab, 10 ref.

Descriptors: *DDT, *Polychlorinated biphenyls, *Lake Michigan, *Pesticide residues, *Fish, Water pollution effects, Organic pesticides, *Residue levels.

Museum specimens of six species of fish taken from Lake Michigan from 1929 through 1966 were analyzed for dieldrin, polychlorinated biphenyls and DDT analogs. The specimens, obtained from the Universities of Wisconsin and Michigan, were preserved in glass jars filled with ethyl alcohol. Dieldrin first appeared in two samples from 1955. No trends in residue levels during subsequent years could be determined, and levels were usually low, ranging from 0.20 to 2.39 ppm. No PCB's were detected in museum samples until 1949 and the PCB level shows a progressive increase from 1949 through 1966. It is suggested that concentrations of PCB's in Lake Michigan fish remain high deposite sales restrictions to closed system users in 1971 by the sole producer of PCB's in the United States. Among the specimens, PCB's were never detected in the absence of DDE. DDT and its analogs were first detected in 1949 and appeared in the same specimens in which PCB's were found. DDT increased progressively through 1965, peaking in that year. The data and results from the Great Lakes Fishery Laboratory suggest that DDT residues have been decreasing since the late 1960's. (Coyle-Wisconsin)
W78-02497

EFFECTS PRODUCED BY EXTRACTS OF MACROSCOPIC MARINE ALGAE ON BACTERIAL GROWTH, (IN SPANISH),
Universidad Central de Venezuela, Caracas. School of Biology.
For primary bibliographic entry see Field 5C.
W78-02498

EFFECT OF CHEMICAL AMELIORATION ON BIOLOGICAL PROCESSES IN SOLONETZ SOIL AT DIFFERENT IRRIGATION LEVELS, (IN RUSSIAN),
Moskovskaya Selskokhozyaistvennaya Akademiya (USSR). Div. of Soil Science.
For primary bibliographic entry see Field 2G.
W78-02499

WATERFOWL AS INDICATOR FOR THE ECOLOGICAL QUALITY OF LAKES, (IN GERMAN),
H. Utschick.
Verh Ornithol Ges Bayern 22(3/4), p 395-438, 1976.

Descriptors: *Bioindicators, *Waterfowl, Water quality, Lakes, Eutrophication, Productivity, Pollutant identification, Bavaria, Biomass, Cygnus-olor, Eutrophication, Grebe, Kochelsee, Loisach, Mute, Podiceps-cristatus, Rivers, Swan, West Germany.

Data of the international waterfowl census in S Bavaria (West Germany) were used to test for correlations between wintering waterfowl and the degree of lake eutrophication. The lakes were categorized in oligo-, meso-, eu- and polytrophic ones. Biomass and density of waterfowl are positively correlated with increasing eutrophication. This is based on the increasing productivity due to pollution of the lakes, by which the food biomass, which can be utilized by waterfowl, becomes greater. Species diversity declines when eutrophication increases. Possibly a weak optimum exists in the case of mesotrophic lakes. The rate of increase in wintering waterfowl population is growing with the degree of eutrophication. If further pollution is stopped, the numbers of waterfowl will decline. This has happened at 2 Bavarian lakes due to ring canalization. On Kochelsee, an eutrophic lake, waterfowl are feeding on polytrophic ones. This may be caused by the daily mixing of the lake by water discharge of a power plant and the input of nutrients by the heavily polluted river Loisach. Species usable as indicators for the degree of eutrophication are the great crested grebe Podiceps cristatus and the mute swan Cygnus olor, if numbers of the swan are not influenced much by additional feeding by people. The shore region of 4 large Bavarian lakes are ranked in order of their waterfowl count and conclusions regarding their water pollution are given.--Copyright 1978, Biological Abstracts, Inc.
W78-02501

KEPONE BIOCONCENTRATION, ACCUMULATION, LOSS AND TRANSFER THROUGH ESTUARINE FOOD CHAINS,
Environmental Research Lab., Gulf Breeze, FL.
For primary bibliographic entry see Field 5C.
W78-02502

UTILIZATION OF EXOGENOUS PURINE AND PYRIMIDINE COMPOUNDS BY BACTERIA ISOLATED FROM WATER BASINS, (IN RUSSIAN),
Latvian State Univ., Riga.
A. Ya. Lishmane, and M. Ya. Vitols.
Prikl Biokhim Mikrobiol 13(2), p 225-230, 1977.

Descriptors: *Bacteria, *Organic compounds, Purine compounds, Pyrimidine compounds, Isolation, Latvian-SSR, Nitrogen, Pseudomonas-Spp, Sarcina-Spp, USSR.

Bacteria (including Pseudomonas and Sarcina spp.) isolated from Latvian SSR (USSR) water basins were cultivated on media that contained purine and pyrimidine bases as the sole N source. Some bacteria were able to grow in these media.--Copyright 1978, Biological Abstracts, Inc.
W78-02503

CHEMICAL AND MINERALOGICAL COMPOSITION OF THE SEDIMENTS OF LAKES WITH LOW BIOLOGICAL PRODUCTIVITY, (IN ESTONIAN),
Akademiya Nauk Estonskoi SSR, Tartu. Inst. of Zoology and Botany.
A. Lindpere.
Eesti Nsv Tead Akad Toim Biol 26(1), p 49-55, 1977.

Descriptors: *Lake sediments, Mineralogy, Pollutant identification, Chemical analysis, Lakes, *Estonian-SSR, USSR.

The sediments from 10 lakes of the Estonian SSR (USSR) were studied. The lakes are situated on a sandy catchment area and have only a few insignificant influxes or lack them completely. The samples were taken at or near the maximum depth of each lake, from an upper layer (0-20 cm) of sediment. In the analyses for Ca, Fe, Al, P and K, the sediment material was ashed at 500 degrees C and the ash was dissolved in HCl. Si with undissolved residue was determined gravimetrically. An Elemental analyzer was used to determine the total C and N content. The mineralogical composition of the sediments investigated was determined by means of X-ray analysis. All results are expressed in percentages on the basis of the oven-dry (105 degrees C) weight of the sediment. The organic matter content of sediments did not drop below 62.7%, except for the samples from L. (lake) Piigandi and L. Vaikjarv. The total C and N content of sediments in many cases exceeds 40 and 3%, respectively. The mean concentration of P was 0.42% PzO5. The richest in P was the sediment from L. Viitna Linajary which is polluted by human activity. The P content of sediments from

L. Uljaste, L. Kirikumae, L. Pahi and L. Pullijary was small (0.24-0.28% P O). The lakes have inflows from raised bogs. The content of P is not correlated with the content of other elements. Significant correlations between S, Al, Fe and K indicate that these 4 elements derive mostly from silicates. The major minerals of thelake sediments are quartz (60-85%), feldspar (10-25%) and plagioclase (0-20%). The Ca content of sediments varied from 0.53-1.29%, on the average 0.89% CaO. The sediments revealed insignificant variation in their Ca content. The sediment of the most oligotrophic lakes in Estonia, L. Valgejarv and L. Viitna Pikkjar, are the poorest in Ca. The sediments of lakes with low biological productivity are characterized by high organic matter and low Ca accumulation.–Copyright 1978, Biological Abstracts, Inc.
W78-02504

APPLICATION OF STOCHASTIC METHODS IN EUTROPHICATION,
General Electric Co., Santa Barbara CA. Center for Advanced Studies.
For primary bibliographic entry see Field 5C.
W78-02506

COMPARATIVE HYGIENIC CHARACTERISTICS OF WORK CONDITIONS WITH DIFFERENT TECHNOLOGICAL METHODS OF IODINE PRODUCTION FROM DRILLING WATERS, (IN RUSSIAN),
Institut Gigieny Truda i Professionalnykh Zabolevanii, Baku (USSR).
A. I. Zamchalov, I. I. Alekperov, and V. Elisuiskaya.
Gig Tr Prof Zabol 12, p 17-19, 1976.

Descriptors: Industrial wastes, *Iodine, Methodology, *Public health, Pollutant identification, Atmosphere, *Carbon absorption method.

Working conditions in the extraction of iodine from drilling waters by the carbon-adsorption method (CAM) and aero-desorption (ADM) technological methods are characterized by the action of a complex of adverse factors (iodine vapor content in the air and in individual sections also of chlorine and sulfuric acid). CAM uses nonmechanized processes and manual operations. ADM distinguishes itself to advantage by using hygienically more favorable work conditions as a result of compounded processes, mechanization of manual operations, hermetic sealing of reactors and a comparatively low pollution of the atmospheric environment near and around the work places, making it preferable to CAM.–Copyright 1978, Biological Abstracts, Inc.
W78-02507

THE INFLUENCE OF ORGANIC MATTER AND ATMOSPHERIC DEPOSITION ON THE PARTICULATE TRACE METAL CONCENTRATION OF NORTHWEST ATLANTIC SURFACE SEAWATER,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 5B.
W78-02512

INSECTICIDE RESIDUES ON STREAM SEDIMENTS IN ONTARIO, CANADA,
Department of Agriculture, London (Ontario). Research Inst.
J. R. W. Miles.
Pesticides Monitoring Journal, Vol 10, No 3, p 87-91, December 1976. 2 fig, 4 tab, 12 ref.

Descriptors: *DDT, *DDD, *Bed load, *Pesticide residues, Tobbaco, *Canada, *Ontario(Canada), *Suspended sediment, *Bottom material, *Vegetable muck area.

Insecticide residues on suspended and bottom sediments of streams in Ontario, Canada, were studied in a tobacco growing and vegetable muck area. The TDE:DDT values for Muskoka River bottom mud samples taken in September, 1971, were 1.6, 1.9, 2.4 and 5.4 DDT was banned in Ontario in 1970, suggesting that DDT on eroded soil incorporated in the bottom mud in the spring was gradually converted to TDE by microorganism activity from May through September. Also sampled from source to mouth was the Big Creek stream in Norfolk County, Ontario, which drains a tobacco growing area. Samples were taken in one day and overall change in TDE:DDT from source to mouth was 20 times. Average DDT in bed load samples was three times that in the bottom material. Dieldrin was also three times greater and endosulfan was six times greater in the bed load. Animals living in the bed load may be exposed to more insecticide than would be suggested by bottom material analysis alone. Residues on suspended sediment from Big Creek samples ranged from eight to 100% of the whole water analyses. Considerable dilution with uncontaminated bottom material occurs on deposit of sediment and/or DDT degrades more quickly in the bottom material. (Coyle-Wisconsin)
W78-02513

AQUATIC NITROGEN DETERMINATIONS IN REAL-TIME,
Connecticut Univ., Storrs. Dept. of Civil Engineering.
T. Helfgott, and J. S. Mazurek.
Progress in Water Technology, Vol 8, No 4-5, p 433-446, 1977. 7 fig, 6 tab, 24 ref.

Descriptors: *Nitrogen, *Ammonia, *Measurement, Pollution abatement, Sewage treatment, Treatment facilities, Water pollution control, Nutrient removal, Analytical techniques, Instrumentation, *Nitrogen removal, Real-time.

A measurement system for real-time determination of aquatic borne nitrogen was evaluated and nitrogen removals and interactions within a pilot plant were studied in order to develop control strategies for aquatic nitrogen pollution abatement from sewage treatment plants. Measurements were taken in a train of unit steps composing of a model pilot plant conventional sewage treatment plan, followed by several advanced waste treatment unit processes and operations. It was found that with 15 minutes total nitrogen, ammonia, nitrate and organic nitrogen data can be obtained using, respectively, a total nitrogen analyzer, an ammonia probe, and a nitrate probe. Organic nitrogen can be estimated by subtracting ammonia probe and nitrate probe data from total nitrogen data. But when levels of sensitivity are approached, the accumulative error becomes predominant. Although analysis time is within 15 minutes, continuous monitoring is only feasible with the probes. Decisions leading to control of nitrogen through treatment with effective control strategies can be made with the accumulated research data available. (Coyle-Wisconsin)
W78-02515

DETECTION OF SMALL AMOUNT OF VIRUSES (ENTEROVIRUSES) IN DRINKING WATER, (IN FRENCH),
Clermont-Ferrand Univ. (France). Lab. of Bacteriology and Virology.
D. Beytout, H. Charrier, and M. Monghal.
Ann Microbiol (Paris) 128A(2): 255-262. 1977.

Descriptors: *Pollutant identification, Methodology, *Viruses, *Potable water, *Enteroviruses, *Adenoviruses.

A simple method to detect entero-viruses and adenoviruses in drinking water was developed, using a cellulose nitrate membrane adsorption-elution technique. Average entero viruses recovery is 23-80% when 30 l of water containing 60 PFU (plague forming units) are monitored. Only 10% of adenoviruses are recovered in the same conditions. This method allowed the detection of 12 PFU of enteroviruses in 120 l of water. Recovery of 1 PFU in 10 l when examining >100 l is reproducible.–Copyright 1978, Biological Abstracts, Inc.
W78-02525

DETERMINATION OF ORGANIC MATTER IN WATER: A REVIEW, (IN SWEDISH),
National Swedish Environment Protection Board, Stockholm. Undersokhningslab.
G. Ekedahl.
Vatten 32(4), p 328-336, 1976.

Descriptors: *Organic matter, *Pollutant identification, *Reviews, Water analysis, Oxygen demand, Chemical oxygen demand, Biochemical oxygen demand, Carbon, Chloride, Mercury.

A brief literature review and a critical assessment of different methods for determination of organic matter in water are presented. Historically, organic pollutants have been measured indirectly in terms of an equivalent Oz demand, measured biologically (biochemical Oz demand, BOD) or chemically (chemical Oz demand, COD). The Oz demand tests are valuable tools for evaluating the effects of organic pollutants on the water body, but do not give a precise determination of total organics. Introduction of modern equipment has opened the way for the new determinants total organic C (TOC) and total Oz demand (TOD). These new determinants should not be considered a relacement for COD or BOD, but rather valuable, additional parameters. BOD, COD, TOC and TOD do not measure the same aspects of organic pollution, neither theoretically nor practically, even though these parameters sometimes are correlated in a statistical sense. Some guidelines or references are given for the satisfactory disposal of Hg containing wastes. The use of Hg in the COD-analysis should be adapted to the chloride content of the sample. For samples with chloride concentrations less than 100 mg/l a Hg-free COD-method is proposed. In some cases the permanganate-method may be profitably used. For samples low in organic matter and high in chloride content the COD-determination is replaced by TOC or TOD.–Copyright 1978, Biological Abstracts, Inc.
W78-02526

THE DETERMINATION OF ORGANIC CARBON BY THE PERSULFATE METHOD IN CHLORIDE-RICH WATER, (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Inst. Biologii Vnutrennykh Vod.
B. A. Skopintsev, E. S. Bikbulatov, and N. Yu. Mel'Nikova.
Okeanologiya 16(6), p 1109-1114, 1976.

Descriptors: *Organic carbon, Chlorides, *Organic matter, *Pollutant identification, Carbon dioxide, Chlorides, Nitrogen, Potassium, Sodium, Sulfates.

Organic matter in inland water including colored humic compounds is completely oxidized by potassium persulfate. In the removal of CO2 from acidified water by N blow in the presence of persulfate, part of organic matter is lost. The loss increases with increasing blow time. In the presence of NaCl (at chlorinity approximately equal to 19%) organic matter in inland water is not oxidized completely. Silver sulfate introduction (in equivalent, by Cl-, quantity) results in a complete oxidation of organic matter.–Copyright 1978, Biological Abstracts, Inc.
W78-02529

DETERMINATION OF CARAGARD IN WATER, SOIL AND PLANT MATERIAL BY THIN LAYER CHROMATOGRAPHY, (IN RUSSIAN),
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Gigieni i Toksikologii Pestitsidov, Kiev (USSR).

S. G. Gevorkyan, M. S. Petrosyan, A. E. Vasilenko, and G. S. Stepanyan.
Gig Sanit 12, p 78-80, 1976.

Descriptors: *Chromatography, *Pollutant identification, *Caragard, Herbicides, Pesticide residues, Chemcontrol, Methodology, Soil analysis, Apples, Fruit crops, Orchards, Toxicity.

A method is presented for determination of caragard, a herbicide used to control annual and perennial weeds and applied in the early spring to apple orchards in doses of 15-20 kg/ha. Caragard is one of a group of symmetric triazines, 2 components of which show mild to medium toxicity to mammals. The determination method is based on extraction of the preparation by an organic solution of chloroform, n-hexane and acetone, followed by purification of the extract and subsequent TLC. Quantitative determination of the preparation with reliable accuracy can be conducted up to 50 mgk in the sample and the method was approved for the detectuon of residual quantities of caragard in the soil treated in doses of 6.8 and 10 kg/ha, and in fruit.--Copyright 1978, Biological Abstracts, Inc.
W78-02533

MONITORING GROUNDWATER QUALITY,
Environmental Protection Agency, Las Vegas, NV. Office of Research and Development.
G. B. Morgan, E. A. Schuck, and L. G. McMillion.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 818, Price codes: A02 in paper copy, A01 in microfiche. Report No. EPA-600/J-77-008. Published in Water Quality Bulletin, Vol. 2, No. 1, p 11-14, January, 1977. 3 p, 2 tab, 15 ref.

Descriptors: *Groundwater, *Water quality control, *Monitoring, Methodology, Publications, Pollutant identification, *Groundwater quality.

Recent emphasis on the need to protect groundwater quality has been provided by the U.S. Congress through the Federal Water Pollution Control Act Amendments of 1972 and the Safe Drinking Water Act of 1974. Present ground water monitoring programs, however, were designed mainly to assess the quantity and quality of ground water available for a particular use. To prevent contamination of ground water resources, a monitoring program must go beyond this and must provide a systematic approach to detecting and delineating ground water pollution before the pollution reaches the point of use. In response to this challenge, a monitoring methodology has been developed under the sponsorship of the U.S. Environmental Protection Agency. The methodology is briefly discussed and the published reports that contain details on it are summarized and referenced. (Eberle-NWWA)
W78-02547

STUDY OF WATER-SOLUBLE ORGANIC SUBSTANCES IN NATURAL WATER USING GEL CHROMATOGRAPHY, (IN RUSSIAN),
Moskovskaya Selskokhozyaistvennaya Akademiya (USSR), Div. of Soil Science.
L. P. Stepanova, I. S. Kaurichev, and A. I. Karpukhin.
Izv Timiryazev S-Kh Akad 6, p 97-105, 1976.

Descriptors: *Organic wastes, *Gel chromatography, *Pollutant identification, Soil water, Moscow, *Podzolic soils, Soddy, Soils, USSR.

The fractionation of water soluble organic substances of natural soil water and water extract of soddy podzolic soil of the Moscow (USSR) region using systematized gel chromatography with the use of molselects G-10 and G-50 showed that composition and properties are not alike. The presence of high- and low- molecule compounds, the percentage of which depended on the nature of water soluble organic substances studied was typical of all the objects. MW fractions of the objects studied differed in the degree of saturation with ions of Fe and Al. The water soluble organic substances of surface water on the farm Mikhailovsoye were highest in Fe ions. Distribution of the radioactive isotope sq Fe according to MW fractions gave qualitative information about the strength of the bond of organo-mineral compounds, namely, the higher the specific activity per unit of C the higher the stability of organo-mineral compounds.-Copyright 1978, Biological Abstracts, Inc.
W78-02555

DESIGN FOR A UNIFIED SYSTEM FOR CHARACTERIZING CONTINENTAL BODIES OF WATER AND ITS USE FOR WATER QUALITY ANALYSIS, (IN RUSSIAN),
V. N. Zhukinskii, O. P. Oksiyuk, Y. Y. Tseeb, and V. B. Georgievskii.
Gidrobiol Zh 12(6), p 103-111, 1976.

Descriptors: *Design, *Classification, *Water quality, Water analysis, Ecosystems, Pollutant identification, Productivity, Sanitation, Ukrainian-SSR, USSR.

A design for a unified system for characterizing and subsequently classifying and typing bodies of water is described. The system is suitable for computer formalization, and may be continually improved. The proposed design includes 5 tables for classifying hydrological, hydrochemical, hydrobiological, functional-energetic and water quality characteristics of bodies of water. A letter-number matrix characterizing an elementary water ecosystem is presented on the basis of data on shallows of the Kremenchug Reservoir (Ukrainian SSR, USSR). The system is valuable for unifying data for the evaluation, control and prognosis of the sanitary-biological condition and bioproductivity of bodies of water, as well as for the optimal use of their water and biological resources.-Copyright 1978, Biological Abstracts, Inc.
W78-02559

AIR AND WATER CONTAMINATION BY 3,4-BENZPYRENE FROM ROAD ABRASION, (IN GERMAN),
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Hygiene und Arbeitsphysiologie.
M. Waibel.
Zentralbl Bakteriol Parasitenkd Infektionskr Hyg Erste Abt Orig Reihe B Hyg Betriebshyg Praev Med 163(5/6), p 458-469, 1976.

Descriptors: Air pollution, *Benzpyrene, Abrasion, Pollutant identification, Asphalt, Dust, Sewage, Tar, Water pollution.

Abrasion of tar-containing or bituminous road surfaces causes particles to be liberated which contain carcinophilic poly-aromatic hydrocarbons (e.g., 3,4-benzpyrene (BP)). The effects of abrasion were determined by comparative measurements alongside a highway section of tar asphalt and one of concrete, both subjected to an identical traffic load. Airborne dust, sedimented dust near the ground and the degree of sewage pollution were measured. The wearing layer of the tar-asphalt surface consisted of TA 16: maximum grain size 16 mm; bonding agent TB 2000 (containing 13% tar pitch and 87% bitumen). With a mean traffic load of 9000 vehicles/day abrasion liberated 15 mg BP/mo. in winter and in summer 10 mg BP/mo. and per 1 m length of a 2-laned highway. In the coarser dust particles the abrasion material containing BP prevails. The tar asphalt abrasion in precipitated dust contained more than 50% of total benzpyrene, while its share amounted even to 70% of the total load in the floating fraction of waste water.--Copyright 1978, Biological Abstracts, Inc.
W78-02562

BIOLOGICAL METHODS OF HERBICIDE RESIDUE DETERMINATION IN WATER, (IN CZECH),
Vyzkumne Ustavy Rostlinne Vyroby, Prague (Czechoslovakia). Ustav Ochrany Rostlin.
J. Zemanek, J. Kovar, and R. Sterba.
Ochr Rostl 12(2), p 99-107, 1976.

Descriptors: *Herbicides, *Pesticide residues, 2-4-D, *Pollutant identification, Methodology, Analytical techniques, *Atrazine, Cucumbers.

Two methods of herbicide residue determination in water were developed. For the determination of 2,4-D herbicide residues a laboratory method was used, whereas for the atrazine residue determination a water culture was employed. In both cases the test plant was cucumber (Cucumis sativus) and as a criterion of the herbicidal effect inhibitions of root growth were considered. The methods make it possible to establish in water 2,4-D herbicide concentration up to 0.05-0.1 mg/l and those of the atrazine herbicide between 0.1-0.5 mg/l. Simulated rain precipitations washed altogether 44.6% of the initial amount of the 2,4-D herbicide and 19% of the original amount of atrazine through a soil layer 5 cm thick.--Copyright 1978, Biological Abstracts, Inc.
W78-02574

ASSESSMENT OF THE QUALITY OF RECLAIMED WATER BY TOTAL ORGANIC CARBON LEVEL, (IN RUSSIAN),
V. M. Skuratov, V. B. Gaidadymov, and S. V. Chizhov.
Kosm Biol Aviakosm Med 10(6), p 66-70, 1976.

Descriptors: Analytical techniques, *Pollutant identification, Space technology, Urine, *Organic carbon.

Possible application to space technology of measuring the total content of organic C to evaluate the quality of reclaimed water was discussed. The content of organic C, ration of chemical consumption of Oz and C in the atmospheric condensate, urine, condensate of urine in low-temperature evaporation and potable water reclaimed from these sources were examined.--Copyright 1978, Biological Abstracts, Inc.
W78-02576

INVESTIGATIONS ON DISSOLVED URANIUM, SILICON AND ON PARTICULATE TRACE ELEMENTS IN ESTUARIES,
Physical Research Lab., Ahmedabad (India).
D. V. Borole, S. Krishnaswami, and B. L. Somayajulu.
Estuarine and Coastal Marine Science, Vol 5, No 6, p 743-754, November 1977. 6 fig, 4 tab, 29 ref.

Descriptors: *Uranium radioisotopes, *Silica, *Trace elements, *Water chemistry, *Estuarine environment, Colloids, Mineralogy, Clays, Chemical properties, Water analysis, Estuaries, Mixing, Salinity, Sea water, Water quality, Radioactivity, Water properties, Oceanography, *India, *Narbada Estuary(India), *Tapti Estuary(India), *Godavari Estuary(India).

The concentrations of dissolved uranium and silicon and the chemical composition of suspended phases in the Narbada, Tapti, and Godavari estuaries were measured as a function of chlorosity. The results suggested that the uranium behaves conservatively in all the three estuaries; whereas silicon shows conservation behaviour in the Narbada and Tapti estuaries and non-conservative in the Godavari estuary. The variation of chemical composition of particles with chlorosity does not show any systematic trend; the observed scatter can be attributed to variations in mineralogy and size distribution of these particles. The data on chemical composition also indicated that in these estuaries the degree of desorption of elements from particles is much less than those reported for European estuaries. (Henley-ISWS)

W78-02595

REMOTE SENSING REPORT, PACIFIC NORTHWEST AREA, WASHINGTON, OREGON, IDAHO, APRIL AND JULY 1973.
National Field Investigation Center, Denver, CO.
For primary bibliographic entry see Field 7B.
W78-02611

RESEARCH PROGRAM ON HAZARD PRIORITY RANKING OF MANUFACTURED CHEMICALS: PHASE II--FINAL REPORT (CHEMICALS 41-60),
Stanford Research Inst., Menlo Park, CA.
S. L. Brown, F. Y. Chan, J. L. Jones, D. H. Liu, and K. E. McCaleb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 163, Price codes: A09 in paper copy, A01 in microfiche. Report No. NSF-RA-E-75-190C, April 1975. 192 p, 20 tab. ECU-3386.

Descriptors: *Chemical properties, *Chemical analysis, Chemical potential, Hazards, Toxicity, Environmental effects, Biological properties, Physical properties, Public health, Chemicals, *Toxicology.

In Phase II of a two-phase effort 80 chemicals having the greatest potential for environmental effects were studied. Chemicals numbered 41 through 60 are described: (ethylenedinitrilo) tetraacetic acid, tetrasodium salt; benzidine; zine di(butylexyl) phosphorodithioate; N-(1,4-dimethlpentyl)-N'-phenyl-p-phenylenediamine; vinyltoluene; 2-mercaptobenzothiazole; chloroform; methyl bormide; acetonitrile; di(2-ethylhexyl) phthalate; vat blue dye No. 6 (7,16-dichloroindanthrone); di(2-ethylhexyl) adipate; dichlorobenzidine; hexamethylenetetramine, tech; dimethylamine; acyclic xanthic acid salts (sodium isopropylxanthate-Dow Z-11); sulfolane; p-nonylphenyl manganese phosphite; nitrilotriacetic acid, trisodium salt; and diarylarylenediamines, mixed (Wingstay 100). Information was collected on the extent of the exposure of the environment to these chemicals during manufacture and use and on the possible environmental effects of this exposure (chemical, physical, and biological properties, persistence, and toxicity). A questionnaire survey of industry was conducted to determine the amount and types of losses in the manufacturing plants. Information from the survey is tabulated in four formats: Flow diagram of industrial data on amounts used for various applications; assessment of data gathered on toxicology and environmental persistence; computer printout of a tubular summary of important data gathered; and pertinent abstracts found on toxicology. (See also W78-02659) (Wares-IPA)
W78-02614

AN AUTOMATED MULTISAMPLE-STREAM CHEMICAL MONITORING SYSTEM,
Environmental Research Lab., Athens, GA.
H. P. Kollig.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 314, Price codes: A02 in paper copy, A01 in microfiche. Report No. EPA-600/J-77/002, 1977. Published in American Laboratory, Vol. 9, No. 2, p 47-52, 1977. 5 fig, 2 tab, 1 ref. IBA609.

Descriptors: *Pollutant identification, *Automation, *Water analysis, Water pollution, Rivers, Nitrogen, Phosphorus, Carbon, Chemical analysis, Standards, Data processing, *Technicon autoanalyzer.

An automated system has been designed and operated successfully for two years for chemical analysis of nitrogen, phosphorus, and carbon compounds in the study of the fate of pollutants. Nine samples from along a simulated river are pumped into the laboratory, and eight different chemical analyses (total Kjeldahl nitrogen, ammonia, nitrite, nitrate, total phosphorus, orthophosphate, chemical oxygen demand, and glucose) are performed on each sample in a consecutive and automated mode with built-in internal standardization. The samples are directed by a series of solenoid valves, activated by either a mechanical or a solid state sequencer. The analyses are done with Technicon autoanalyzers in a continuous flow mode, and data processing is performed by a computer linked to the system. The unlimited number of samples that may be analyzed (dependent only on volume of sample that can be pumped) and the means of keeping the system clear of bacterial growth by means of cooling and frequent automatic cleaning are advantages of the system. The system provides a basis for additional models for other applications. (Wares-IPA)
W78-02616

EPA METHOD STUDY 8, TOTAL MERCURY IN WATER,
Environmental Monitoring and Support Lab., Cincinnati, OH.
J. Winter, P. Britton, H. Clements, and R. Kroner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 270, Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA-600/4-77-012, February 1977. 78 p, 12 fig, 21 tab, 10 ref, 1 append. IHD621, EPA P.O. No. 5-03-4294.

Descriptors: *Pollutant identification, *Water analysis, *Mercury, Methodology, Evaluation, Water pollution, Statistics, *Cold vapor technique, Accuracy, Interference.

Results of a joint Environmental Protection Agency/ASTM evaluation study of a method of analysis for total mercury in nautral water and waste waters are presented. The cold vapor technique includes an acid-permanganate-persulfate digestion at 95 degrees Centigrade for two hours followed by reduction and measurement of mercury in the vapor phase at 253.7 nm. Precision and accuracy which can be expected in routine work were estimated by preparation and measurement of samples containing similar but slightly different, mercury concentrations. Recovery from natural water samples was calculated by difference, and recoveries for all concentrations were compared and significant statistical measures such as standard deviation mean recovery were calculated. Recovery data received from participating laboratories indicated acceptable precision and accuracy of the method for a wide range of background water, with insensitivity of the method to natural interferences implied. (Wares-IPA)
W78-02617

THERMOMETRY IN THE CONTROL OF WATER QUALITY,
National Bureau of Standards, Washington, DC.
S. D. Wood.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 608, Price codes: A07 in paper copy, A01 in microfiche. Report No. NBSIR 77-1227 (NBS), May 1977. 22 p, 2 fig, 1 tab, 28 ref.

Descriptors: *Water analysis, *Thermal pollution, Water temperature, Monitoring, Data collections, Measurement, Regulation, Operations, Effluents, Waste water(Pollution), Thermometers, *Thermometry.

A limited study of thermometry in water polluted focused on water analysis, thermal pollution, and the work of standards committees. Water pollution is addressed by over 200 different regulations at the state level as well as by many federal laws, some laws requiring monitoring. All industries, governmental agencies, and individuals who discharge effluents into navigable waters must monitor their own effluents for chemical and bacterial contaminants, and steam electric generating, cement, and sugar processing industries are required to monitor (and control) their effluent temperatures. State and local regulatory agencies also monitor water effluents to see that discharges conform to permitted limits. It was estimated that there were about 167,000 temperature entries per year (7% of total) in the EPA file of water pollution data, some 70% of which were generated by agencies of the Federal government. Some other temperature measurements are routinely made by government agencies which are not entered into EPA file presently, representing a potential source of additional information on thermometry. Such data are routinely needed and generated for water analysis, thermal pollution, utilities operation, plume monitoring, reservoir management, and biological research. The major deficiencies in thermal pollution thermometry lie in areas of system reliability and operator training. Recommendations are made for data quality control, sound engineering practices, personnel training in use of equipment, and development of more rugged and specialized sensors for use in field work. (Wares-IPA)
W78-02618

MONITORING ENVIRONMENTAL IMPACTS OF THE COAL AND OIL SHALE INDUSTRIES RESEARCH AND DEVELOPMENT NEEDS,
Radian Corp., Austin, TX.
D. C. Jones, W. S. Clark, W. F. Holland, J. C. Lacy, and E. D. Sethness.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 292, Price codes: A10 in paper copy, A01 in microfiche. Report EPA-600/7-77-015, February 1977. 207 p, 56 fig, 49 tab, 255 ref, 2 append. EHB 529, Task 25, 68-02-1319.

Descriptors: *Forecasting, *Monitoring, *Water quality, *Air pollution, *Land use, Data collections, Oil shales, Oil, Coals, Fuels, Environmental effects, Technology, *Fuel conversion.

The extraction, processing, and conversion of coal and oil fuels were examined with regard to their impacts on air quality, water quality, and land use, including consideration of the technology for slurry pipeline transportation of coal. Promising technologies identified for coal and oil conversion include coal extraction, coal slurry pipelines, coal cleaning, coal gasification, coal liquefaction, oil shale extraction, oil shale retorting, and shale oil upgrading. For each technology, data were developed on air emissions, water emissions, thermal emissions (water only), solid wastes, land use, and water requirements. Known and potential environmental emissions of specific chemical species were identified and quantified from data available in the literature. Correlations were drawn with other industries and specific cases were discussed. It was concluded from an examination of exposure pathways, dependence of pathways on design and location of facilities, and potential impacts of specific chemicals that only sulfates and particulates are likely to present environmental problems. Areas indicated as important for monitoring and predicting coal and oil conversion environmental impacts include: development of techniques for continuously measuring low concentration species in the ambient environment, accurate techniques for monitoring ground water quality, and improved particulate monitors and remote sensing instrumentation. (Wares-IPA)
W78-02619

ASTP CHEMICAL AND MICROBIOLOGICAL ANALYSIS OF POTABLE WATER,
National Aeronautics and Space Administration, Houston, TX. Lyndon B. Johnson Space Center.
R. L. Sauer, and S. A. Leslie.
Available from the National Technical Information Service, Springfield, VA 22161 as N77-11675, Price codes: A02 in paper copy, A01 in microfiche. Technical Memorandum No. NASA TM-58192, October 1976. 13 p, 6 tab, 2 ref. JCS-11578; 199-73-01-05-72.

Descriptors: *Pollutant identification, *Water quality, *Potable water, Standards, Water analysis, *Spaceflight environment, Apollo-Soyuz Test Project.

The Apollo-Soyuz Test Project procedures for potable water system servicing and the results of preflight and postflight chemical and microbiological analyses of the water are discussed. Adequacy and quality analyses for the command and service module water servicing and dispensing system were made by injecting sodium hypochlorite, a buffer, and inhibitor into the water system and collecting water samples both before and after flight for chemical and microbiological analysis. The preflight chemical analysis showed that the pH of the drink gun samples taken before liftoff and of the final fill hot water port samples was lower than the specification limit. Postflight chemical analysis showed a nickel concentration calculated as 1.68 mg/liter and specific conductivity and total residue exceeding specification limits. Bacterial growth in all preflight samples was within specification limits, but exceeded specification limits upon postflight samples. All chemical and microbiological data indicated that the potable water was within acceptable limits, and the crew indicated that the water tasted reasonably good during the course of the mission. Results of analyses are presented in tabular format. It was concluded that the Apollo-Soyuz potable water system was adequate. (Wares-IPA)
W78-02621

ON-LINE MEASUREMENT OF THE INFRARED SPECTRA OF GAS CHROMATOGRAPHIC ELUENTS,
Ohio Univ., Athens. Dept. of Chemistry.
P. R. Griffiths.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 570, Price codes: A03 in paper copy, A01 in microfiche. Final Report No. EPA-600/4-76-061, December 1976. 22 p, 2 fig, 7 ref. 1BA027, R803517-01-0.

Descriptors: *Analytical techniques, *Gas chromatography, *Spectrometers, Interferometry, Infrared radiation, Feasibility studies, Absorption, Sampling, Instrumentation, Measurements, Fourier analysis, Gases, Interfaces, Optical properties, *Pollutant identification, *Infrared spectrometry, Detectors, Digitization noise, Optical systems, Sensitivity.

Techniques have been developed to increase the sensitivity of the interface between a gas chromatograph and a rapid-scanning Fourier transform infrared spectrometer (GC-IR). A single-beam system, in which a triglycine sulfate detector is used to measure the interferogram, has been designed and constructed. Identifiable infrared spectra of submicrogram quantities eluting from a gas chromatograph have been measured without trapping the sample by use of this system. A double-beam configuration for GC-IR has also been designed so that a cooled mercury cadmium telluride detector can be used to further decrease the detection limits without limiting the sensitivity by digitization noise. Each of these systems necessitates the use of light-pipes with relatively long (30 cm) absorbing paths but low reflection losses. Feasibility studies showed that the dual-beam Fourier transform technique is uniquely suited for eliminatin of digitization noise problems that are found in Fourier transform infrared spectrometers when a sensitive detector is used for measurement of absorption spectra with an optically efficient sampling configuration. Using this technique, an optical system for GC-IR was designed and is currently being built. Suggestions are made for obtaining further increases in sensitivity through instrumental and sampling modifications, i.e., trigger design and analyte concentration. (Wares-IPA)
W78-02652

DEVELOPMENT OF A METHODOLOGY FOR DESIGNING CARBON MONOXIDE MONITORING NETWORKS,
Systems Applications, Inc., San Rafael, CA.
M.-K. Liu, J. Meyer, R. Pollack, P. M. Roth, and J. H. Seinfeld.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-268 642, Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA-600/4-77-019, March 1977. 62 p, 10 fig, 4 tab, 43 ref. 1HD620, 63-03-2399.

Descriptors: *Pollutant identification, *Air pollution, *Monitoring, Network design, Methodology, Model studies, Pollutants, Meteorology, Measurements, Mathematical models, Systems analysis, *Carbon dioxide, Air quality standards.

The design methodology for a carbon monoxide monitoring network based on the objective of identifying concentrations that exceed the national ambient air quality standards (NAAQS) is presented. The basis for identifying such concentrations is the Concentration Area Time-Product, where the concentrations are integrated over an area (i.e., a grid square in a gridded system) and over a time interval for averaging the concentrations. These are computed with a mesoscale air quality simulation model formulated as a 4-dimensional (x,y,z,t) partial differential equation of mass balance for the pollutant species, which yields space/time average concentration distributions. A frequency-weighted average of concentrations--Figure of Merit--is determined from these projected concentrations distributions, prevailing meteorological patterns, and the frequency of occurrence associated with each of the meteorological patterns. A mapping of these Figure of Merit values provides the basis of selection of the locations and number of sites in the network. A field measurement program provides air quality and meteorological data for model validation and simulation as required in development of the specifications for number and location of sites in the network design. Discussion is limited to design methodology. Previous work is reviewed, and objectives of air quality monitoring programs and factors pertinent to monitoring network design are described. (Wares-IPA)
W78-02653

THE PAST, PRESENT, AND FUTURE OF THE BIOSPHERE,
For primary bibliographic entry see Field 2B.
W78-02654

PROCEDURES FOR EVALUATING OPERATIONS OF WATER MONITORING NETWORKS,
URS Research Co., San Mateo, CA.
R. W. Shnider, and E. S. Shapiro.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 920, Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA-600/4-76-050, September 1976. 80 p, 11 fig, 17 tab, 13 ref. IHD 620, 68-03-0473.

Descriptors: *Monitoring, Networks, Evaluation, Data collections, Operations, Water quality, Management, Cost analysis, Cost allocation, Operations research, Water quality standard, Methodology, Network design, Personnel, Facilities, Equipment, Sampling, Quality control, Data storage and retrieval, *Network monitoring evaluation, *Water monitoring networks, Parameters, Data dissemination.

Procedures for performing an evaluation of the major factors affecting the efficiency and effectiveness of an existing surface water quality monitoring and standards compliance network are presented. The evaluational techniques pertain to subdivisions of network operations including network plan and design, personnel, facilities and equipment, sampling, quality assurance, data distribution and dissemination, agency interaction, total network operations, and budget allocation to technical services. The evaluation technique rates major elements that comprise the functions of each area and influence the effectiveness of output. For each area evaluated, a method is provided for integrating element ratings into an area evaluation, and finally a method is provided for integration of area evaluations resulting in an overall network evaluation. As an example of the procedures, the area of sampling is evaluated by rating parameters monitored and frequency of monitoring, i.e., in the case of mining areas and areas of geothermal activity, parameters would include trace metals, toxic materials, pH, alkalinity/acidity, turbidity/suspended solids, and specific conductance, using established criteria for range and acceptability. It is recommended that the evaluation procedure be carried out by personnel directly involved in the operation of the monitoring network. (Wares-IPA)
W78-02656

RESEARCH PROGRAM ON HAZARD PRIORITY RANKING OF MANUFACTURED CHEMICALS (CHEMICALS 21-40),
Stanford Research Inst., Menlo Park, CA.
S. L. Brown, F. Y. Chan, J. L. Jones, D. H. Liu, and K. E. McCaleb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 162, Price codes: A03 in paper copy, A01 in microfiche. Report No. NSF-RA-E-75-190B, April 1975. 196 p, 20 fig, 20 tab, 21 ref. ECU-3386.

Descriptors: *Chemicals, *Environmental effects, Industrial wastes, Water pollution, Effluents, Toxicity, Chemical properties, Physical properties, Biological properties, Persistence, Hazards, Priorities, Public health, Chemical industry, Chemical analysis, *Environmental exposure, Flow diagrams, Toxicology.

Chemicals 21 through 40 of the 80 chemicals chosen by an advisory panel of experts on trace contaminates as having the greatest potential for environmental exposure and effect. The chemicals studied were benzene (chemical uses), silicone fluids, nitrobenzene, toulenediisocyanate, xylenes (mixed total), aniline, dimethyl terephthalate, trichlorofluoromethane, p-dichloro-benzene, 2, 2-dithiobis (benzothiazole), o-dichlorobenzene, tetrabromoethane, 4, 4-methylene (bis)-2-choloroaniline, polyhalogenated biphenyls (Aroclor 1254), tricresyl phosphate, fluorescent brightening agents (No. 28), polyvinyl chloride, methylene chloride, 1, 3-dichloropropene/1, 2-dichloropropane mixture, and ethyl chloride. Information was collected on the extent of the exposure of the environment to these chemicals (during manufacture and use) and on the possible environmental effects of this exposure (chemical, physical, and biological properties, persistence, and toxicity). A questionnaire survey of industry was conducted to determine the amount and type of losses in the manufacturing plants; information from the survey is tabulated. Summary reports are presented for each chemical in the form of a flow diagram showing industrial data on the amounts used for various applications, an assessment of the data gathered on toxicology and environmental persistence, a computer printout of a tabular summary of important data gathered, and copies of the 25 most pertinent abstracts found in the area of toxicology, (See also W78-02614) (Wares-IPA)
W78-02659

LAB MODERNIZATION CREATES NEW PROBLEMS FOR PLANT OPERATORS,
Water Quality Lab., Las Cruces, NM.
D. W. Clark.
Water and Sewage Works, Vol. 124, No. 10, p 82-83, October, 1977.

Descriptors: *Water analysis, *Laboratory tests, *Sampling, *Laboratory equipment, *On-site data collections, Testing, Water quality control, Moni-

toring, Analytical techniques, Waste water treatment.

The addition of a water quality laboratory to the 4.5-mgd waste water treatment plant at Las Cruces, New Mexico has included the installation of automatic samplers, a spectrophotometer, a camera-equipped high power microscope, Kjeldahl nitrogen apparatus, grease extraction apparatus, a continuous-reading electrolytic BOD system, and a water purification system. The need for trained personnel in the field of water quality monitoring is discussed. Major division of water quality analysis for sewage treatment plants include: the identification of finished water contaminants, such as heavy metals and pesticides, and their effects on the environment; evaulations of new treatment processes; development of new testing procedures; surveillance of pollutants unaffected by present treatment processes; protection of the treatment process through upstream monitoring; and the determination of charges for industrial waste effluents. (Schulz-FIRL)
W78-02662

MERCURY CONTENT OF MUSSELS FROM ST. LAWRENCE ESTUARY AND NORTHWESTERN GULF OF ST. LAWRENCE, CANADA,
E. Bourget, and D. Cossa.
Marine Pollution Bulletin, Vol. 7, No. 12, p. 237-239, December 1976. 1 fig, 3 tab, 21 ref.

Descriptors: *Bioindicators, *Mussels, *Mercury, *St. Lawrence River, Estuarine environment, Water pollution sources, Canada, Toxicity, *Gulf of St. Lawrence.

A survey utilizing mussels as bioindicators was carried out to evaluate levels of mercury contamination of the lower St. Lawrence estuary (from the mouth of the Saguenay to Grosses-Roches) and part of the Gulf of St. Lawrence. Adult specimens of Mytilus edulis L. ranging between 2.5 and 4 cm were collected on rocky shores at mid-tidal level at 30 stations distributed over 1000 km along the estuary and gulf coasts. Mercury levels, although irregular from place to place, showed a general decrease along the south shore from Riviere du-Loup down to the Gaspe Peninsula. Mean values ranged between 0.160 to 0.629 ppm (dry weight). Highest values were found upstream at the mouth of the Saguenay Fjord and on the south shore of the lower estuary to Grosses-Roches Station 14 (mean 0.430 + or - 0.023 ppm). Lowest mercury concentrations were observed on the eastern part of the north shore (mean 0.72 + or - 0.062 ppm). Intermediate mercury concentrations (mean 0.306 + or - 0.028 ppm) were found along the coast of the Gaspe Peninsula. It appears that the mercury content of mussels in the estuary reflects the overall seaward dillution of mercury from terrigenous sources. (Harris-Wisconsin)
W78-02671

EVALUATION OF AN INDUCTIVELY COUPLED PLASMA, MULTICHANNEL SPECTROMETRIC ANALYSIS SYSTEM,
Ames Lab., IA.
R. K. Winge, J. M. Katzenberger, and R. N. Kniseley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 918, Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA-600/4-77-032, June 1977. 56 p, 8 fig, 12 tab, 14 ref. 1BD612, 1CC614, EPA-IAG-D6-0417.

Descriptors: *Spectrometers, *Chemical analysis, *Evaluation, *Water analysis, *Pollutant identification, Water supply, Sampling, Methodology, Trace elements, Lighting, *Atomic emission spectrometry, Optical equipment, Plasma quantometer, Excitation, Light levels.

An inductively coupled plasma, multielement atomic emission spectrometric analysis system was evaluated in response to EPA's need for a rapid method for determination of trace element concentrations in water. Main features of the system include the inductively coupled plasma quantometer, plasma radio frequency power supply, sample generation and excitation hardware, and the data aquisition system. Detection limits were obtained periodically from the system under several sets of operating conditions; The system was evaluated on performance parameters, which included detection limit capabilities, analytical curve fitting, analytical curve reproducibility, and photomultiplier performance. Results showed that the data acquisition of the system performed well and approached the state-of-the-art for the types of equipment involved. The polychromator, in which high stray light levels may cause significant analytical errors, especially for such critical elements as arsenic, lead, and selenium was found to be deficient. The need for a signal measuring system with a wider dynamic range and provision for reduction in warm-up time of the system were indicated. With reduced stray light levels, development of empirical methods for correction of remaining matrix-related background changes, and improvements in nebulizer performance, the inductively coupled plasma multielement atomic emission spectrometric analysis system should be the most practical approach for rapid multielement determinations of trace elements. (Wares-IPA)
W78-02672

A STUDY OF NEW CATALYTIC AGENTS TO DETERMINE CHEMICAL OXYGEN DEMAND,
Texas Southern Univ., Houston.
R. F. Wilson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 965, Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA-600/4-77-038, May 1977. 38 p, 14 tab, 9 ref, 9 append. 1BA027 1HA323, R803779-01.

Descriptors: *Pollutant identification, *Water analysis, *Catalysts, Chemical reactions, *Chemical oxygen demand, Sampling, Oxidation, Costs, Methodology, *Analytical techniques, *Silver sulfate, *Magnesium sulfate.

A study was conducted to find a catalyst to replace silver sulfate in chemical oxygen demand determination using the dichromate reflux method in order to recude the cost of the determination. Other catalysts considered were acetic acid, benzene, tert-butyl alcohol, ethyl alcohol, formaldehyde, 3-hydroxypyridine, oleic acid, pyridine, sucrose, and toluene. Results showed that among the catalysts investigated, silver sulfate is generally the best for carrying out chemical oxygen demand determinations, but practically the same results could be obtained from samples in the high-level range of approximately 500 milligrams by using a reduced amount of silver sulfate in combination with magnesium sulfate. To illustrate the modified procedure, a method was attempted for determining the chemical oxygen demand values of solutions having sample concentrations in the low-level range 5 to 50 milligrams. The method is a modification of the standard Moore procedure, in that a combination of silver sulfate, aluminum sulfate, and magnesium sulfate is used to replace the silver sulfate catalyst. The revised procedure was found to be comparable in completeness of oxidation and approximately one-fourth as expensive as the Moore procedure. Further research on analysis variables is recommended; appendices contain tabular data obtained during the evaluative determinations. (Wares-IPA)
W78-02673

ELECTRICAL DETECTION PROBLEMS IN WATER ANALYSIS BY SPARK SOURCE MASS SPECTROMETRY,
Virginia Univ., Charlottesville. Dept. of Chemistry.
W. W. Harrison.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 822, Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA-600/4-77-042, October 1977. 49 p, 8 fig, 4 tab, 43 ref. 1BD713, R801829-03-0.

Descriptors: *Pollutant identification, *Water analysis, Instrumentation, Optical properties, Bioassay, Sampling, Trace elements, Electrical properties, Chemical analysis, *Spark source mass spectrometry, Accuracy, Ashing, Detection.

Research on factors affecting accuracy in spark source mass spectrometry (SSMS) is reported and the applications of SSMS to water-related problems are discussed. The project also involved the development of instrumental additions to improve the operation and control of SSMS procedures, particularly with respect to making the technique more quantitative and easier to use. Modification included: a spark gap monitor pick-up coil, a modified telescope mount to align electrodes on the ion beam axis and view discharge during sparking, modified spark shield to provide light entrance from the top, substitution of a continuously variable collector slit for the standard two position slit, replacement of the standard source chamber by a larger unit, and computation of a linear ratio output for peak area comparison by inputting logarithmic output of the ratio amplifier to an antilog converter. The application of the improved SSMS equipment and procedures was demonstrated in ashing of biological tissue (high and low temperature dry ashing and wet ashing). Results of use of the modified SSMS system showed that if close attention is paid to experimental variables, the technique can complement other analytical methods for obtaining qualitative and quantitative information on trace elements in water and related samples such as sediments and tissues. The SSMS technique is claimed to be invaluable in large regional, state, or federal laboratories for use on materials that require complete elemental screening. (Wares-IPA)
W78-02674

RESIDUAL 2,4-D LEVELS IN THE ST. JOHNS RIVER, FLORIDA,
Army Engineer District, Jacksonville, FL.
J. C. Joyce, and H. C. Sikka.
Journal of Aquatic Plant Management, Vol 15, p 76-82, June 1977. 3 fig, 2 tab, 7 ref. Corp of Engineers DACW 39-74-C-0068.

Descriptors: *2-4-D, *Herbicides, *Pesticide residues, *Aquatic weed control, Florida, Water hyacinth, Chemcontrol, Rivers, Crabs, River basins, *St Johns River(FL), Eichhornia crassipes, Blue crabs, Callinectes sapidus.

In tests of water and blue crabs from the St. Johns River (FL), no excessive accumulation of the water hyacinth control herbicide 2,4-D were found. The use of the herbicide was suspended in December 1973 by EPA directive because 2,4-D had not been registered for use in flowing waters. Under a special exemption, operations were resumed on May 1974, but terminated again in October 1975. This study was conducted between May 1975 and January 1976 to evaluate residual 2,4-D levels expected to occur in naturally flowing waters and shellfish during large-scale water hyacinth control operations. Dimethylamine salt of 2,4-D was applied by airboat at 2.24 kg/ha or aircraft at 4.48 kg/ha. Quantities applied in any one section for a month ranged from 0-820 gal, and for a day from 0-340 gal. Water samples were collected between July 1975-January 1976 at nine locations on the river, which flows 502 km from Vero Beach to the Atlantic Ocean at Jacksonville. Blue crabs (Callinectes sapidus), were obtained locally. The 2,4-D concentrations in water samples varied from indetectable levels to 1.30 ppb, well below the 0.1 mg/l (ppm) tolerance limit set for 2,4-D in potable waters. No correlation was found between quantities of 2,4-D in potable waters. No

correlation was found between quantities of 2,4-D applied and the amount detected in the water, there was no apparent build-up of 2,4-D in downstream waters, and no 2,4-D was detected in crabs collected during the treatment period. (Lynch-Wisconsin)
W78-02679

ON THE ORIGINAL LOAD OF THE PROCESS WATER DURING PAPER PRODUCTION BY DISSOLVED SUBSTANCES. PART I: INVENTORY OF STONE GROUNDWOOD PRODUCTION (UEBER DIE DURCH GELOESTE SUBSTANZEN VERURSACHTE BELASTUNG DES FABRIKATIONSWASSERS BEI DER PAPIERHERSTELLUNG. TEIL I: BESTANDSAUFNAHME BEI DER ERZEUGUNG VON STEINSCHLIFF),
Technische Hochschule, Darmstadt (West Germany). Inst. fuer Paperfabrikation.
L. Goettsching, W. Luettgen, and H-L. Dalpke.
Das Papier, Vol. 31, No. 7, p 257-263, 1977. 3 fig, 4 tab, 6 ref.

Descriptors: *Pulp wastes, *Pulp and paper industry, *Fibers(Plant), *Chemical oxygen demand, Pilot plants, Industrial wastes, Biochemical oxygen demand, Organic wastes, Wood wastes, Waste water treatment.

Results of a survey of waste characteristics for waste water produced during various phases of stone groundwood production in paper manufacturing are presented. The operation of a pilot plant for the production of stone groundwood is described. Concentrations of various inorganic and organic substances, COD, and BOD are presented for waste water as well as for the initial load during grinding. The COD present in the wood fiber is then evaluated with respect to the amount released through the dissolution of the fiber material. Differences in the initial BOD concentrations of industrial groundwood plants and the pilot plant were attributed to inherent differences in the BOD levels of the rinse waters. The relationship between the initial COD load and the ambient temperature in the grinder pit of the groundwood slurry is described. (Schulz-FIRL)
W78-02683

THE UPTAKE, DISTRIBUTION, AND DEPURATION OF 14C-BENZENE AND 14C-TOLUENE IN PACIFIC HERRING CLUPEA HARENGUS PALLASI,
National Marine Fisheries Service, Auke Bay, AK. Auke Bay Lab.
For primary bibliographic entry see Field 5C.
W78-02687

SOME LABORATORY CULTURED CRUSTACEANS FOR MARINE POLLUTION STUDIES,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
W. Y. Lee.
Marine Pollution Bulletin, Vol. 8, No. 11, p 258-259, November 1977. 1 tab, 12 ref.

Descriptors: *Crustaceans, *Water quality control, *Bioindicators, *Toxicity, *Laboratory tests, Methodology, *Copepods, *Amphipoda, *Isopods, Aquiculture, Reproduction, Laboratory animals, Bioassay, Invertebrates, Acartia, Sphaeroma, Amphithoe, Laboratory populations, Culture techniques.

Three laboratory cultured crustaceans are recommended for use in marine pollution studies because they are characterized by (1) wide distribution, (2) a short life cycle, (3) high reproductive potential, and are (4) representative of the plankton and benthos in coastal waters and the intertidal zone, where oil spills most often occur and refinery wastes are discharged. Methods of culturing these crustaceans are described. The crustaceans are Acartia tonsa, a planktonic copepod, Sphaeroma quadridentatum, an isopod, and Amphithoe valida, an amphipod. (Katz)
W78-02695

5B. Sources Of Pollution

BIOLOGICALLY INITIATED AUTO-CATALYTIC MERCURY CONVERSION AND ITS EFFECT ON ELEMENTAL MOBILITY,
Ohio State Univ., Columbus. Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W78-02201

A MULTI-PARAMETER WATER QUALITY MANAGEMENT MODEL FOR RIVER BASINS,
Cornell Univ., Ithaca, NY. Center for Environmental Research.
For primary bibliographic entry see Field 5G.
W78-02202

RUNOFF FROM SOFTWOOD PLOTS THAT HAVE BEEN THINNED AND CLEARCUT,
Mississippi Univ., University. Dept. of Geology and Geological Engineering.
For primary bibliographic entry see Field 4C.
W78-02204

ENVIRONMENTAL POLLUTION BY HEAVY METALS,
For primary bibliographic entry see Field 5C.
W78-02215

ALPHA- AND GAMMA-BHC IN TAMAGAWA RIVER WATER, JAPAN (SEPTEMBER 1968 TO SEPTEMBER 1969),
Tokyo Metropolitan Univ. (Japan). Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W78-02218

TEMPERATURE EFFECTS ON BOD STOICHIMETRY AND OXYGEN UPTAKE RATE,
Caldwell Consulting Engineers, Walnut Creek, CA.
T. M. Flegal, and E. D. Schroeder.
Journal Water Pollution Control Federation, Vol. 48, No. 12, p. 2700-2707, December 1976. 8 fig, 3 tab, 10 ref.

Descriptors: *Biochemical oxygen demand, *Oxygen, *Analytical techniques, *Temperature, Absorption, Bacteria, Methodology, Waste water treatment, Stoichiometry.

Three bacterial seed preparation methods tested in laboratory experiments to determine the sensitivity of plateau biochemical oxygen demand (BOD) stoichiometry and oxygen uptake rate to incubation temperatures: (1) substrate-aclimated, grown at 21C ambient temperature; (2) substrate- and temperature-acclimated, grown in respirometer bath at experimental temperature; (3) wastewater aerated at ambient temperature. For methods (1) and (2) a 2-l solutıcn of 400 mg/l glutamic acid plus nutrients was inoculated with 50 ml of settled, filtered wastewater and aerated 24 hours. In method (3) 2 l of wastewater were aerated 24 hours, then settled, filtered, and diluted. Raw wastewater was obtained from two treatment plants in Davis, California. Results showed that plateau stoichiometry was not greatly affected by changes in temperature up to 37C. This finding has practical significance when the plateau is used as a reference point in BOD tests, as constant-temperature incubation probably is not necessary. Plateau BOD determination may thus be more feasible, in contrast to the conventional 5-day procedure which is highly temperature-dependent. Plateau values at each temperature ranged from 2-4%. Plateau BOD is important as the minimum oxygen demand that can be expected in the bio-oxidation of a given wastewater. In addition, the plateau BOD value coupled with cell production measurements provides a more precise estimate of ultimate BOD than 5-day BOD, and in a relatively short period of time. (Lynch-Wisconsin)
W78-02220

RADIUM-226, URANIUM, AND OTHER RADIOLOGICAL DATA COLLECTED FROM WATER QUALITY SURVEILLANCE STATIONS LOCATED IN THE COLORADO RIVER BASIN OF COLORADO, UTAH, NEW MEXICO, AND ARIZONA- JANUARY, 1961 THROUGH JUNE, 1972.
Environmental Protection Agency, Denver, CO. Surveillance and Analysis Div.
For primary bibliographic entry see Field 5A.
W78-02231

WORKSHOP REPORT ON ACID PRECIPITATION AND THE FOREST ECOSYSTEM,
Northeastern Forest Experiment Station, Delaware, OH.
For primary bibliographic entry see Field 5A.
W78-02236

EXAMINATION OF THE ELUTRIATE TEST, A SCREENING PROCEDURE FOR DREDGING REGULATORY CRITERIA,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5A.
W78-02253

MOVEMENT OF PHOSPHOROUS FROM A SEPTIC SYSTEM DRAINFIELD,
Connecticut Agricultural Experiment Station, New Haven.
B. L. Sawhney, and J. L. Starr.
Journal of the Water Pollution Control Federation, Vol 49, No 11, p 2238-2242, November 1977. 2 fig, 2 tab, 24 ref.

Descriptors: *Phosphorous, *Septic tanks, *Water table, Groundwater, Drainage, On-site investigations, Streams, Water pollution, Path of pollutants, Effluents, Soil water movement, Water sampling, Depth, Sorption, *Renovation.

Movement of phosphorus (P) from a septic tank drainfield through the surrounding soil to groundwater and its eventual discharge to surface waters were investigated. Suction probes and tensiometers were installed at various distances below and beside the drainfield to obtain effluent solutions and moisture distribution. Soon after the septic tank was put into use, ponding of the effluent in the trench began. Movement of P from the trench occurred in both the downward and the horizontal directions. The results showed that a soil with a water table deep below the drainfield should renovate wastewater effectively for a number of years and should permit minimum additions of P to the groundwater. Soils with a high or perched water table, on the other hand, likely would permit undesirably large P additions to groundwater. (Visocky-ISWS)
W78-02255

INPUT AND FATE OF PETROLEUM HYDROCARBONS ENTERING THE PROVIDENCE RIVER AND UPPER NARRAGANSETT BAY FROM WASTEWATER EFFLUENTS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
E. S. VanVleet, and J. G. Quinn.
Environmental Science and Technology, Vol 11, No 12, p 1086-1092, November 1977. 4 fig, 2 tab, 23 ref. Natl Sea Grant 04-6-158-44002.

Descriptors: *Water pollution, *Oil pollution, *Sewage effluents, *Oil, *Waste water(Pollution), Oil wastes, Water pollution sources, Waste water disposal, Suspended solids, Water quality, Municipal wastes, Hydrogen ion concentration, Coasts, Estuaries, Organic matter, Estuarine environment, *Coastal water pollution, *Sediment hydrocarbons, *Providence River, *Narragansett Bay, Coastal environment, Fecal coliform bacteria.

A one-year background survey of the petroleum hydrocarbons discharged to the Providence River by a municipal wastewater secondary treatment plant indicated that the plants may be significant contributors to oil pollution in estuarine and coastal waters. The hydrocarbons were discharged primarily in association with the suspended solids. Analysis of suspended material and sediments in the river and upper Narragansett Bay indicated that approximately half of the suspended hydrocarbons were rapidly sedimented out in the river, and the remainder were transported out of the river and throughout the bay. The petroleum products were persistent to 40 cm in some sedimentary cores, with the subsequent emergence of biologically produced hydrocarbons indicating the extent to which oil pollution was present in the sediments. (Henley-ISWS)
W78-02257

ENVIRONMENTAL MODEL OF KISSIMMEE RIVER BASIN,
Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
P. B. Bedient, W. C. Huber, and J. P. Heaney.
Journal of the Water Resources Planning and Management Division, American Society of Civil Engineers, Vol 103, No WR2, Proceedings Paper 13326, p 241-256, November 1977. 10 fig, 2 tab, 13 ref, 2 append.

Descriptors: *Runoff, *Drainage, *Florida, *Model studies, Mathematical models, Water quality, Flood control, Land use, Water pollution, Pollutants, *Path of pollutants, Phosphorus, Rivers, Lakes, Watersheds(Basins), Hydrographs, Hydrology, *Kissimmee River(Fla).

A hydrologic land-use model was developed and applied to the Kissimmee River Basin, Florida. Surface runoff quanity and quality were estimated for changing land-use and drainage patterns in order to explain hydrologic and water quality response along the river. The hydrologic model (HLAND) was based on a daily water balance for each soil land-use type in the watershed. Predicted runoff was routed down the river and compared to measured outflow hydrographs. Phosphorus loading rates were calculated using measured concentrations of total P and predicted runoff volumes. Observed concentrations and loading rates from tributaries along the river correlated well with the drainage density index, defined as the length of drainage network per unit area of watershed. Results indicated that greatest potential for control of runoff quanity and quality exists in on-site storage in marsh, pond, and lake areas. (Sims-ISWS)
W78-02258

METHANE PRODUCTION IN THE WATERS OFF WALVIS BAY,
Woods Hole Oceanographic Institution, MA. Dept. of Chemistry.
M. I. Scranton, and J. W. Farrington.
Journal of Geophysical Research, Vol. 82, No. 31, p 4947-4953, October 20, 1977. 9 fig, 27 ref. NSF DES75-02731, ONR N00014-74-C0262, NR 083-004.

Descriptors: *Methane, *Africa, *Atlantic Ocean, *Sampling, On-site investigations, On-site data collections, Temperature, Water temperature, Oxygen, Phosphates, Gases, Upwelling, Circulation, Ocean circulation, Coasts, Sediments, Bacteria, Oceans, Water chemistry, Data processing, Oceanography, *Walvis Bay(Namibia).

Nine stations were occupied in the vicinity of Walvis Bay, Namibia, during a detailed study of the distribution of methane in this highly productive coastal environment. The principal features of the observed coastal methane distribution included: (1) excess methane in the mixed layer of from 2 times to greater than 300 times solubility equilibrium with the atmosphere, (2) a subsurface maximum, located in the top of the pycnocline, at which concentrations ranged from 2.6 to 440 times solubility equilibrium, (3) an intermediate depth minimum, where concentrations were comparable to those offshore at similar depths and which were attributed to the influence of onshore movement of subsurface offshore water, and (4) a bottom maximum, which was attributed to input of methane to the water column from the anoxic sediments in the Walvis Bay area. An attempt was made to identify the relative importance for methane supply to the coastal mixed layer of in situ biological production and of eddy diffusive and advective transport of methane-rich water which has been in contact with the bottom at the coast. Calculations suggested that both in situ production and physical processes are major sources of excess methane for the highly productive coastal surface waters. However, the complicated circulation patterns make quantification extremely difficult. (Sims-ISWS)
W78-02261

PERSISTENCE OF SOME PHENYLAMIDE PESTICIDES IN THE AQUATIC ENVIRONMENT -- II. ADSORPTION ON CLAY MINERALS,
National Research Centre, Cairo (Egypt). Water Pollution Control.
M. A. El-Dib, and O. A. Aly.
Water Research, Vol. 10, No. 12, p 1051-1053, 1976. 3 fig, 1 tab, 5 ref.

Descriptors: *Adsorption, *Pesticides, *Soils, Hydrogen, Iron, Calcium, Bentonite, Clay, *Phenylamides, IPC, CIPC, Linuron, Neburon, Vitavax.

The capacity of bentonite clays to adsorb phenylamide pesticides was examined, using IPC, CIPC, Linuron, Neburon, and Vitavax in the tests and hydrogen, iron, and calcium forms of clay. A contact time of three days was required to reach equilibrium conditions. Adsorption of the pesticides on the hydrogen, calcium and iron forms of bentonite conformed with Freundlich's isotherm. The higher the computed amount of adsorbent required to reduce the concentration of a particular phenylamide solution, the lower will be the efficiency of the adsorbent. Hydrogen clay has the highest adsorption capacity, followed by iron clay, then by calcium clay. With hydrogen bentonite, slight differences exist with respect to the amount of clay required for the removal of a given amount of Linuron, Neburon or IPC; CIPC and Vitavax still required higher doses of the hydrogen clay for removal. With the calcium and iron forms, adsorption increases in the order of Vitavax, CIPC, IPC, Linuron and Neburon. Considerable amounts of bentonite would be needed to bring about removal of these pesticides from polluted surface water. (Spaeth-Wisconsin)
W78-02264

AVAILABILITY AND CONCENTRATION OF POLLUTANTS FROM AMERICAN FALLS RESERVOIR SEDIMENTS TO FORAGE AND PREDACEOUS FISHES,
Idaho State Univ., Pocatello.
D. W. Johnson, J. C. Kent, and D. K. Campbell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 564, Price codes: A06 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, Moscow, Completion Report, March 1977. 95 p, 7 fig, 11 tab, 90 ref, 2 append. OWRT A-043-IDA(2), 14-34-0001-6013.

Descriptors: Reservoirs, *Sediments, *Chlorinated hydrocarbon pesticides, DDT, Dieldrin, *Polychlorinated biphenyls, *Mercury, Water pollution, *Cadmium, Metals, Fish, *Idaho, *Heavy metals, *Pesticide residues, *American Falls Reservoir(Idaho).

Predominant chlorinated hydrocarbons and heavy metal residues in American Falls Reservoir sediments, water and dominant 'rough' and 'game' fish are reported. Chlorinated hydrocarbon residues (DDT metabolites, dieldrin, and PCB's) vary with fish species and age. The mean value for PCB's in large suckers was 671/microgram/kg in contrasted to the EPA recommendation that it be no greater than 500 microgram/kg. Mercury and cadmium were found in all species analyzed for those particular metals. Results indicate that the Food and Drug Administration's standard of 0.5 mg/kg may be exceeded in crappie, suckers, and large rainbow trout. The mean value for mercury in water was 0.9 microgram/l. The Environmental Protection Agency has recommended, for the protection of fish and predatory aquatic organisms, that total mercury concentration in unfiltered water should not exceed 0.2 microgram/l at any time or place. The World Health Organization has recommended daily intake of cadmium be not more than 70 microgram/day. Consumption of fishes from the reservoir would exceed the recommended limit. The maximum concentration of cadmium in the water was seven times the value considered by the National Academy of Sciences to be an environmental threat. Arsenic was found only in the sediments and water. It was not detected in any of the fishes sampled. (Trihey-Idaho Univ)
W78-02265

STORM OVERFLOW DESIGNERS NEED GREATER FEEDBACK.
Surveyor, Vol. 150, No. 4448, p 22, September, 1977.

Descriptors: *Combined sewers, *Storm water, *Urban runoff, *Storm runoff, *Sewerage, Design criteria, Monitoring, Separated sewers, Waste water treatment, Scotland.

A recent report of the Working Party on Storm Sewage (Scotland), published by the Scottish Development Department, has suggested that although information is sketchy, storm overflow does not appear to be a serious problem in Scotland. The survey by the Working Party indicated that of the 2000 storm overflows observed in Scotland, approximately 20% could be considered hazardous by local authorities. The report suggested that Scottish rivers were probably able to assimilate the storm water without adverse effects and that elimination of all storm overflows was probably not economically feasible. A series of 10 recommendations were presented: direction of storm water to sanitary sewers in industrial areas served by separate systems, elimination of dual manholes, identification of existing storm and sanitary sewers, inspections and supervision of overflows and connections to sanitary sewers, designing of sewers and manholes to minimize blockage, and use of storage or settling basins where feasible. (Schulz-FIRL)
W78-02298

DESIGNING RETENTION BASINS FOR SMALL LAND DEVELOPMENTS,
McElhanney Surveying and Engineering Ltd., Surrey (British Columbia).
For primary bibliographic entry see Field 5G.
W78-02299

URBAN STORM RUNOFF MODEL,
CH2M Hill, St. Louis, MD.
E. W. Rovey, and D. A. Woolhiser.

Journal of the Hydraulics Division, Proceedings of ASCE, Vol 103, No HY11, p 1339-1351, November, 1977. 8 fig, 3 tab, 12 ref.

Descriptors: *Storm water, *Computer models, *Urban runoff, *Estimating, *Storm runoff, Urban hydrology, Hydrographs, Hyetographs, Urban drainage, Model studies, Mathematical models, Hydrology.

Kinematic equations for overland flow and flow in an open channel, as well as the derivation of an infiltration curve as a function of time from ponding and infiltration rate, are presented. A computer model has been developed to approximate the response of a watershed to a specified rainfall event with respect to overland flow on a rectangular surface, open channel flow in a trapezoidal channel, free surface flow in a circular conduit, and general watershed geometry. Input required for the model includes geometric parameters estimated from a topographic map of the watershed, parameters for surface resistance to flow, and infiltration parameters for pervious surfaces. Overland flow resistance coefficients are listed for various surface types. The 165-acre Hillcrest Drain watershed in Northglenn, a suburb of Denver, Colorado, is cited as an example of the use of the model to simulate runoff hydrographs with input of several observed rainfall hyetographs. Simulations of three observed storms were marked by underestimation of the initial peak of discharge and overestimation of the peak rate and volume, although peaking timing prediction was good. For a storm which consisted of two definite pulses of rainfall, the first peak was underestimated while the second peak was overestimated. The inability to predict the difference between actual rainfall and all losses is suggested as contributing to the differences between actual and computed results. Problems associated with estimation of the antecedent moisture condition of the soil and with the spatial distribution of gauging stations within the watershed are discussed. (Schulz-FIRL)
W78-02300

SAMPLES OF RHINE WATER REVEAL ORGANIC CARBON CONTENT,
Karlsruhe Univ. (West Germany). Dept. of Water Chemistry.
H. Sontheimer.
Water and Wastes Engineering, Vol. 14, No. 10, p 24, 26-27, October, 1977. 2 fig.

Descriptors: *Rivers, *Foreign countries, *Organic compounds, *Chemical oxygen demand, *Water analysis, Waste assimilative capacity, Water quality, *Path of pollutants, Hydrologic data, On-site collections, Waste water disposal.

Dissolved organic carbon, COD, ultraviolet extinction, oxygen content, temperature, and flow rate were measured in water samples collected at seven stations along the Rhine River in West Germany. Because current, temperature, and the nature and quantity of pollutants contribute to a wide variation in organic substances within the Rhine, the geometric means of several analyses was used in comparisons of analytical data with time of collection and location. The analyses indicated that a major increase in dissolved organic carbon, COD, and ultraviolet extinction occurred at Mainz, where effluents from the Mannheim-Ludwigshafen area were discharged. Concentrations below this point were relatively constant despite further considerable discharges of effluent, verifying the river's capacity for self-purification. The study concluded that the total dissolved organic carbon pollutant load increased with flow rate. A decrease in the load of biologically degradable substances with a decrease in flow rate was attributed to more time available for self-purification under conditions of low flow rate. Since deviations in COD values were greater than in dissolved organic carbons from curve fitting of 1970-1974 values, the use of dissolved organic carbon rather than COD was suggested for determining river quality. An equation to estimate pollutant loading with respect to flow rate was presented. The effects of the large BASF water treatment plant in Ludwigshafen on the quality of the Rhine were discussed. (Schulz-FIRL)
W78-02383

STUDY OF A SEPTIC TANK SYSTEM ON A LAKE SHORE: TEMPERATURE AND EFFLUENT FLOW PATTERNS,
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.
M. M. Gibbs.
New Zealand Journal of Science, Vol 20, No 1, p 55-61, March, 1977. 7 fig, 10 ref.

Descriptors: *Septic tanks, *Effluents, *Infiltration, *Groundwater, *Analytical techniques, Subsurface mapping, Soil investigations, *Path of pollutants, Municipal wastes, Waste water disposal.

Septic tank effluent seepage was mapped over a shallow groundwater table near Lake Taupo in New Zealand to determine whether septic effluent was entering the lake. Because conventional tracer methods were prohibited by the area's low groundwater velocities, the extent and direction of movement was traced by measuring temperature changes produced at the groundwater surface by the effluent. A network of 10-mm dia borholes laid out on a grid pattern at 1-m centers was used to monitor effluent motion. The boreholes were equipped with a rapid response thermistor mounted in the tip of a rod of a low thermal conductivity substance. A finite difference method was used to determine the path of the effluent from the septic tank soakhole to the test borehole. Elevated temperatures were observed in the surface water at nearly all of the borehole sites, with a sharp thermal gradient below about 0.2 m and background groundwater temperature at about 1 m. A thermal plume which emanated from the soakhole was observed, with effluent water travelling considerable distances before entering the groundwater. The thermal buoyancy of the septic tank effluent and the thermal gradient between it and the background groundwater confined effluents to the upper 0.2 m of the water table at distances greater than 8 m from the soakhole. The probability of septic effluents reaching Lake Taupo in this situation was considered significant. This groundwater temperature mapping technique is recommended for areas where low groundwater velocities or anisotropic soil properties limit the application of traditional tracer techniques. (Schulz-FIRL)
W78-02385

DOES POLLUTION ABATEMENT IMPROVE AQUATIC LIFE,
Normandeau Associates, Bedford, NH.
N. Savage, and J. Alcamo.
Water and Wastes Engineering, Vol. 14, No. 9, p 198, 111-112, 158, September, 1977. 4 fig, 2 tab, 2 ref.

Descriptors: *Aquatic life, *Environmental effects, *Mathematical models, *Path of pollutants, Rivers, Water pollution control, On-site data collections, Hydrologic data, Waste assimilative capacity, Waste water disposal.

The environmental effects of water pollution control efforts are discussed with respect to finfish and benthic invertebrates in the Merrimack River in Massachusetts. SNSIM (Stream Network Simulation) was used as a computerized mathematical model for this analysis. The model, developed by the EPA in 1974, calculates carbonaceous BOD of a stream from carbonaceous BOD values for point source loads and tributaries. The dissolved oxygen content is calculated with respect to the oxygen demand from biochemical breakdown of nitrogenous wastes; algal production and respiration of oxygen; benthal oxygen demand; and diffusion of atmospheric oxygen. Reaction coefficients on which the mode is based include the oxidation rate of nitrogenous BOD and carbonaceous BOD by bacteria, the rate of algal assimilation of ammonia and nitrate, and the diffusion rate of atmospheric oxygen into the river. Use of the model requires data preparation, model calibration and refinement, and water quality projections. The Merrimack River was divided into segments according to flow, velocity, cross-sectional area, and depth. Water quality projections were calculated on the basis of 7-day, 10-yr low flow conditions. Projections of aquatic organism response were evaluated according to the sensitivity of the organism to pollutants and a direct linear relationship between dissolved oxygen concentration and biological response. The study concluded that changes in resident aquatic organism populations were not widespread as a result of pollution abatement schedules, although substantial improvements were observed in certain highly polluted stretches of the river. (Schulz-FIRL)
W78-02390

OCCURRENCE AND DISTRIBUTION OF BACTERIAL INDICATORS AND PATHOGENS IN CANAL COMMUNITIES ALONG THE TEXAS COAST,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
S. M. Goyal, C. P. Gerba, and J. L. Melnick.
Applied and Environmental Microbiology, Vol. 34, No. 2, p 139-149, August, 1977. 6 fig, 7 tab, 31 ref.

Descriptors: *Coliforms, *Canals, *Estuaries, *Enteric bacteria, *Salmonella, Sewage bacteria, On-site data collections, Saline water-freshwater interfaces, Disinfection, Sewage disposal, Microorganisms, Texas, Soil analysis, Water analysis, Sea water, Waste water disposal.

The occurrence and distribution of bacterial indicators and pathogens were examined in residential canals of six Texas coastal communities which use a variety of waste disposal methods. The disposal systems include three which utilize collection systems and treatment plants, one in which sewage was initially collected in septic tanks and which later changed to collection and treatment, and two in which disposal was 25% septic tank and 75% collection system and treatment plant. Other parameters measured for the canals included depth and age. Measurements of coliforms, fecal coliforms, and salmonella were made in the surface water and bottom sediments of the canals over a 17-month period. The most-probable-number (MPN) method was used to analyze all samples. The results indicated that there was no significant correlation between organism concentrations and physical-chemical characteristics of canal waters such as temperature, pH, turbidity, and suspended solids. Organism concentrations, however, did decrease as the salinity increased. Levels of enteric bacteria in the sediment were higher, often by a factor of several logs, than in the accompanying surface water. The rapid increase in bacteria concentrations in surface waters was attributed to the desorption of bacteria in the sediment as a result of decreasing salinities. (Schulz-FIRL)
W78-02391

THE DELINEATION OF A POINT SOURCE PLUME BY THE STUDY OF BACTERIAL POPULATIONS,
Canada Centre for Inland Waters, Burlington (Ontario).
S. S. Rao, and R. P. Bukata.
Journal of Applied Bacteriology, Vol. 43, No. 1, p 61-66, August, 1977. 6 fig, 5 ref.

Descriptors: *Lakes, *Rivers, *Microorganisms, *Analytical techniques, *Bioindicators, Path of pollutants, Coliforms, Remote sensing, Aerial photography, Environmental gradient, Hydrology,

*Lake Ontario, Great Lakes, Streptococcus, Aerobic bacteria, Temperature, Mixing, *Niagara River(Canada).

The radial sampling grid method and remote sensing techniques were used to examine the plume of Niagara River water in Lake Ontario. Water samples were collected at nine sampling stations on four radii from the mouth of the Niagara River and analyzed for aerobic heterotropic bacteria, coliforms, fecal coliforms, and fecal streptococci. Thermal scans over the Niagara plume and aerial infrared photography indicated that the thermal regimes estblished by the merging lake and river had the same spatial distribution as microbial populations. The aerobic heterotropic bacterial populations were indicative of lake waters, while the coliforms and streptococci were indicative of river water. The microbiological data were used to define the main impact zone of the river, the zone of minor influence of the plume, and non-plume lake waters. Microbiological and air remote sensing measurements are suggested for use in studies on the dynamic interaction of lakes and rivers at the source of discharge. (Schulz-FIRL)
W78-02392

GROUND WATER QUALITY MODEL OF THE CHIPUXET AQUIFER IN THE UPPER PAWCATUCK RIVER BASIN,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
A. S. Marcus, W. E. Kelly, and L. J. Kirschenbaum.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 767, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, (1977). 20 p, 15 fig. OWRT A-061-RI(1).

Descriptors: *Groundwater, *Aquifers, Water pollution sources, Model studies, Rhode Island, *Chipuxet Aquifer(RI), *Water quality models, Measurements, *Specific conductivity, Monitoring.

The Chipuxet Ground Water Aquifer is located in Kingston, R.I. The apparent pollution sources are a landfill, highways, agriculture and farming areas, and residential septic systems. Both wells and surface water quality measurements were made in an attempt to trace pollution sources into, through, and out of the aquifer. While many chemical measurements were made the major part of the report deals with specific conductivity measurements. The conclusions indicate that some of the suspected pollution sources were successfully monitored.
W78-02402

NITROGEN SOURCE DIFFERENTIATION THROUGH CARBON ISOTOPES,
Nebraska Univ., Lincoln. Conservation and Survey Div.
R. F. Spalding.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 777, Price codes: A03 in paper copy, A01 in microfiche. Nebraska Water Resources Research Institute, Lincoln, Completion Report, September 1977. 31 p, 2 fig, 1 tab, 25 ref, append. OWRT A-047-NEB(1), 14-34-0001-7058.

Descriptors: *Nitrogen, *Nitrates, *Carbon isotopes, Groundwater, Water pollution sources, *Nebraska, *Platte River(Neb), Water wells, Sampling, Dissolved organic carbon, *Nitrate-nitrogen, Isotopic studies.

Fifty-one groundwater samples and one Platte River surface water sample were analyzed for nitrate-N, dissolved organic carbon (DOC), and 13C ratios. Ten samples contaning sufficient NO3-N (> 5.0 ppm) were analyzed for 15N. Water samples were pumped from 51 observation wells located in a 25 square mile area near the Platte River south of Shelton, Nebraska. Wells were chosen such that any concentration or isotopic differences could be related to areal land use and depth. Ranges in concentrations and isotopic ratios were 0.0 to 27.0 mg/l, 0.5 to 4.8 mg/l, -15.6 to -25.4, and +4.7 to +11.5 for nitrate-N, DOC, 13C and 15N. DOC concentrations were negatively stratified with depth indicating the soils are the predominant source of DOC to the groundwater reservoir. Highest DOC concentrations always appeared in shallow wells adjacent to the intensively farmed areas. Heavier 13C values were always associated with these wells and appear to reflect the decomposition of either field corn or corn-fed animal waste products. Nitrogen isotopes indicate the major nitrogen contamination to vary between animal wastes and fertilizer depending on the land use near the well. Wells in cottonwood groves, islands, pastures and hay meadows had very low NO3N concentrations (1.0 ppm), lower DOC concentrations, and lighter 13C values averaging -22.5.
W78-02406

TIME OF TRAVEL OF SOLUTES IN MISSISSIPPI RIVER FROM BELLE CHASSE TO THE VICINITY OF HEAD OF PASSES, LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
A. J. Calandro.
Louisiana Department of Transportation and Development, Baton Rouge, Office of Public Works, Water Resources Technical Report No 13, 1977. 5 p, 5 fig, 6 ref.

Descriptors: *Water pollution sources, *Path of pollutants, *Flow rates, *Mississippi River, Wastes, *Tracking techniques, Tracers, Dye releases, Dye dispersion, Dye concentrations, Time of concentration, Mathematical models, Forecasting, Louisiana, Mississippi, *Time of travel(Solutes), *Accidental spills.

Accidental spills of pollutants could be harmful to water users along a river. Planners and downstream water users should have knowledge of the behavior of dissolved pollutants accidentally spilled into the river. A water tracer was injected into the Mississippi River near Belle Chasse, La., (mile 77.0) to determine the travel-time, the maximum concentration, the dispersion characteristics, and the duration of a tracer cloud for the reach from Belle Chasse, La., to the vicinity of Head of Passes (mile 0.0). The average flow in the reach was 468,000 cubic feet per second during the study. Information from this study and from previous studies was used to calibrate a mathematical model developed by the U.S. Geological Survey at the Gulf Coast Hydroscience Center. The model was to generate time-of-travel curves of the leading edge, the peak, and the trailing edge of the tracer cloud for discharge ranging from 200,000 to 1,200,000 cubic feet per second. (Woodard-USGS)
W78-02426

FACTORS AFFECTING THE AVAILABILITY OF SEDIMENT-BOUND CADMIUM TO THE ESTUARINE, DEPOSIT-FEEDING CLAM, MACOMA BALTHICA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 5C.
W78-02427

WATER-QUALITY STUDY OF TULPEHOCKEN CREEK, BERKS COUNTY, PENNSYLVANIA, PRIOR TO IMPOUNDMENT OF BLUE MARSH LAKE,
Geological Survey, Harrisburg, PA. Water Resources Div.
J. L. Barker.
Available from the National Information Service, Springfield, VA 22161 as ADA-045 865, Price codes: A16 in paper copy, A01 in microfiche. Water-Resources Investigations 77-55, September 1977. 59 p, 22 fig, 11 tab, 22 ref.

Descriptors: *Pre-impoundment, *Water quality, *Chemical analysis, Nutrients, Bacteria, Insecticides, Trace elements, Streamflow, Sediments, Evaluation, *Pennsylvania, Berks County(Penn), *Tulpehocken Creek(Penn).

Blue Marsh Lake is planned as a multipurpose impoundment to be constructed on Tulpehocken Creek near Bernville, Berks County, Pennsylvania. Prior to construction, samples of water, bed material, and soil were collected throughout the impoundment site to determine concentrations of nutrients, insecticides, trace metals, suspended sediment, and bacteria. Analyses of water suggest the Tulpehocken Creek basin to be a highly fertile environment. Nitrogen and phosphorus concentrations near the proposed dam site had median values of 4.5 and 0.13 mg/liter, respectively. Suspended sediment discharges average between 100 and 200 tons per day during normal flows but may exceed 10,000 tons per day during storm runoff. Highest yields were measured during winter and early spring. Concentrations range from 3 mg/liter to more than 500 mg/liter. Bed material samples contain trace quantities of aldrin, DDT, DDD, DDE, dieldrin, and chlordane. Polychlorinated biphenyls (PCB's) ranged from 10 to 100 micrograms per kilogram. Soils at the impoundment site are of average fertility. However, the silt loam texture is ideal for attachment and growth of aquatic plants. (Woodard-USGS)
W78-02433

SALINE-WATER INTRUSION RELATED TO WELL CONSTRUCTION IN LEE COUNTY, FLORIDA,
D. H. Boggess, T. M. Missimer, and T. H. O'Donnell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 012, Price codes: A03 in paper copy, A01 in microfiche. Water-Resources Investigations 77-33, September 1977. 29 p, 10 fig, 4 tab, 7 ref.

Descriptors: *Saline water intrusion, *Aquifers, *Water wells, *Well casings, *Florida, Chlorides, Corrosion, Drilling, Water pollution sources, Groundwater, Lee County(Fla), Well construction.

An estimated 30,000 wells have been drilled in Lee County, Florida, since 1900. These wells range in depth from about 10 to 1,240 feet and tap the water-table aquifer of one or more of the artesian aquifers underlying the area. Many of these wells are sources of saline-water intrusion into freshwater aquifers. The artesian aquifers in the lower part of the Hawthorn Formation and upper part of the Tampa Limestone and the Suwannee Limestone have high water levels and contain water with dissolved solids concentrations ranging from 1,500 to 2,400 mg/liter (milligrams per liter). Few of the 3,000 wells drilled to these water-bearing units contain sufficient casing to prevent upward leakage into overlying aquifers; intrusion into the upper part of the Hawthorn Formation has resulted in an increase in chloride concentrations from a normal of 80-150 to 300-2,100 mg/liter. Saline-water intrusion into the upper part of the Hawthorn Formation also has occurred as a result of downward leakage of saline water through corroded metal casings of wells drilled in areas adjacent to tidal water bodies. Where this leakage has occurred, the chloride concentration has increased to as much as 9,500 mg/liter. (Woodard-USGS)
W78-02434

PRELIMINARY DESIGN OF WASTEWATER LAND APPLICATION SYSTEMS,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5E.
W78-02438

INTERNALIZATION IN A STOCHASTIC POLLUTION MODEL,
Tel-Aviv Univ., (Israel). Dept. of Economics.
For primary bibliographic entry see Field 5G.
W78-02440

STATISTICAL MODELS OF RIVER LOADINGS OF NITROGEN AND PHOSPHORUS IN THE LOUGH NEAGH SYSTEM,
Northern Ireland Dept. of Agriculture, Antrim. Freshwater Biological Investigation Unit.
R. V. Smith, and D. A. Stewart.
Water Research, Vol. 11, No. 8, p 631-636, 1977. 1 fig, 3 tab, 15 ref.

Descriptors: *Statistical models, *Computer programs, Rivers, Lakes, *Water pollution control, *Nitrogen, *Phosphorus, Nutrients, Estimating, Flow, Sampling, Equations, Chemical analysis, Systems analysis, *Path of pollutants, *Forecasting, *Waste loads, *Northern Ireland.

To establish nutrient budgets of Lough Neagh in Northern Ireland, and to provide strategies for the reduction of nitrogen and phosphorus, it became necessary to obtain estimates of their inputs to the lake. On the six major rivers entering the lake, continuous flow metering was available but chemical concentrations were only available every 8 or 15 days. To associate river chemical concentrations and loadings with flows for these observed dates, and hence to predict from their relation the loads at the unobserved dates, a computer program using eight possible statistical relations was used. Those methods examined include various regressions with adjustments, higher order (polynomial) fits, logarithmic and other transforms, and different rising and falling flow relations. Results produced by the various methods with discussion of their relative merits are presented. Reasons are given for the final selection of a sample log load on log flow relation for rivers derived from terrestrial catchments. (Bell-Cornell)
W78-02441

A MODELLING METHOD FOR EVALUATING WATER QUALITY POLICIES IN NONSERIAL RIVER SYSTEMS,
Calgary Univ., (Alberta). Faculty of Business.
For primary bibliographic entry see Field 5G.
W78-02442

SENSITIVITY ANALYSIS OF STREETER-PHELPS MODELS,
Consiglio Nazionale delle Ricerche, Milan (Italy). Centro di Teoria dei Sistemi.
S. Rinaldi, and R. Soncini-Sessa.
Research Report No. RR-77-1, International Institute for Applied Systems Analysis, Laxenburg, Austria, February 1977. 18 p, 7 fig, 5 ref.

Descriptors: *River systems, *Water quality, *Simulation analysis, Biochemical oxygen demand, Dissolved oxygen, Flow, Temperature, Thermal pollution, Mathematical models, Equations, Systems analysis, *Streeter-Phelps models, *Sensitivity analysis, Heat discharge, Balance equations.

Sensitivity theory is applied to a class of generalized Streeter-Phelps models in order to predict the variations induced in biochemical oxygen demand (BOD) by the variations of some parameters characterizing the river system. The paper demonstrates the simplicity and elegance of this technique and proves that many relatively complex phenomena can be explained by Streeter-Phelps models. Considered are load variations, flow rate variations, temperature variations, and the interactions between heat pollution and biodegradable pollution. The results are of general applicability and are presented in a very simple analytical form. The main limitation of the study could be the fact that sensitivity theory makes reference only to small perturbations of the parameters. However, the direct comparison with the simulation study carried out by Lin et al. (1973) (See W75-08006) shows that the results obtained herein are largely satisfactory for realistic variations of the parameters of river-quality models.
W78-02444

QUANTITATIVE STUDIES OF FAUNAL LIMITS IN THE NORTH ADRIATIC PHYTAL, USING POLYCHAETES AS AN EXAMPLE, (IN GERMAN),
Vienna Univ. (Austria). Zoologisches Inst.
For primary bibliographic entry see Field 2L.
W78-02451

CONCENTRATION FACTORS AND TRANSPORT MODELS FOR RADIONUCLIDES IN AQUATIC ENVIRONMENTS. A LITERATURE REPORT,
Environmental Monitoring and Support Lab., Las Vegas, NV.
For primary bibliographic entry see Field 5C.
W78-02452

SEASONAL PATTERNS IN ACIDITY OF PRECIPITATION AND THEIR IMPLICATIONS FOR FOREST STREAM ECOSYSTEMS,
Forest Service (USDA), Durham, NH. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 5C.
W78-02455

ENVIRONMENTAL PHOSPHORUS HANDBOOK.
John Wiley and Sons, Inc.: New York, N.Y., 1973. 718 p. $34.95. Griffith, Edward J. (Ed).

Descriptors: Algae, Bacteria, *Environmental effects, Eutrophication, Nutrition, Organic, *Phosphorus, Sea, Viruses, Water pollution, *Ecology, *Pollutant identification, *Path of pollutants.

This handbook's 37 contributing articles define and clarify the various P related topics. Beginning with studies on P in the larger systems, and progressing into the smaller systems, the book continues studies into the microscopic and submicroscopic systems. Several chapters discuss: P in meteorites, lunar samples and the lithosphere; phosphate deposits; inorganic P in seawater and in minerals. The next group of articles discussed P compounds and methods for their study: organic P compounds in aquatic systems; dissociation constants of P-containing chelating agents; polyphosphate deflocculants; pH titration; solubility; hydrolysis; gravimetric analysis; spectrometric methods and gas chromatography detectors. Colorimetric analysis of P at low concentrations, phosphate measurements in natural waters and low-level P detection methods are other topics of discussion. Another group of articles examine the biological aspects of P and/or its compounds: transformation of naturally occurring organophosphorus in the environment; P in human nutrition; biomineralogy of phosphate and physiological mineralization; P nutrition of algae; role of P in bacteria and viruses; phosphorus cycle in lakes; and vertical movement of phosphate in freshwater. Other articles consider role of P in eutrophication, wastewater treatment and ecology. P as a factor in the United States' economy and an editorial on environment P conclude this book.--Copyright 1974, Biological Abstracts, Inc.
W78-02457

A STOCHASTIC MODEL FOR BOD AND DO IN STREAM WHEN POLLUTANTS ARE DISCHARGED OVER CONTINUOUS STRETCH,
South Carolina Univ., Columbia. Dept. of Mathematics and Computer Science.
W. J. Padgett, G. Schultz, and C. P. Tsokos.
International Journal of Environmental Studies, Vol. 11, No. 1, p. 45-55, 1977. 4 fig, 14 ref. U.S. Air Force Office of Scientific Research Grant, AFOSR-75-2711.

Descriptors: *Water pollution sources, *Biochemical oxygen demand, *Dissolved oxygen, *Stochastic processes, Fishkill, *Model studies, Path of pollutants.

A stochastic model for stream pollution is given in terms of a random differential equation giving the biochemical oxygen demand (BOD) and dissolved oxygen (DO) at a distance downstream from a major source of pollution. The joint probability distribution of BOD and DO at each point is derived for several cases and computer-simulated trajectories as well as the mean and variance functions are presented which indicate the statistical properties of the BOD and DO processes. Results are considered important in determining the possibilities of fish kills in the stream as well as in studying the statistical properties of the BOD and DO processes. It is assumed there are five major activities in the stream. First, the pollution (BOD) and DO are decreased by action of the bacteria. Second, dissolved oxygen is increased due to reaeration at a rate proportional to the dissolved oxygen deficit. Third, pollution only is decreased by sedimentation and adsorption at a rate proportional to the amount of pollution present. Fourth, pollution is increased from small sources along the stretch of the stream. And finally, dissolved oxygen is decreased at a measured rate per day. (Coyle-Wisconsin)
W78-02458

FACTORS AFFECTING THE DENITRIFICATION RATE IN TWO WATER-SEDIMENT SYSTEMS,
Agricultural Univ., Wageningen (Netherlands).
For primary bibliographic entry see Field 5D.
W78-02460

IMPACTS OF MAN'S ACTIVITIES ON THE CHEMICAL COMPOSITION IN THE SEDIMENTS OF LAKES ONTARIO, ERIE AND HURON,
Canada Centre for Inland Waters, Burlington (Ontario).
A. L. W. Kemp, and R. L. Thomas.
Water, Air, and Soil Pollution, Vol 5, No 4, p 469-490, June, 1976. 7 fig, 4 tab, 41 ref.

Descriptors: *Sediments, *Lake Ontario, *Lake Erie, *Lake Huron, *Water pollution sources, Great Lakes Region, Chemicals, Water pollution, Sedimentation, Lakes, Sediment-water interfaces, Palynology, Dating, History, Ambrosia, Pollen analysis.

Triple core samples were taken at 14 locations in Lakes Ontario, Erie, and Huron to determine concentrations of organic matter, major elements, and trace elements. The increase in Ambrosia pollen in the sediments with settlement of the area about 120 years ago provided a chronological framework for ascertaining both man's effect on sediment chemical composition over time, and the extent of present-day anthropogenic and natural sediment inputs. It was assumed that differences between presettlement (before 1850) levels of trace elements and nutrients, and surface concentrations, represent net anthropogenic input. Analysis of chemical profiles of the cores for most locations showed that for most of the major elements there was little change in concentration except for small changes near the sediment-water interface. But that a number of elements showed marked enrichments near the sediment surface, including mercury, lead, zinc, cadmium, copper, beryllium, vanadium, organic carbon, nitrogen, and phosphorus. At the Ambrosia horizon only trace amounts of anthropogenic particles were found, presumably due to early shipping on the lakes. Major enrichments in Lakes Ontario and Erie are

estimated to have taken place since about 1950. Nutrient and mercury loadings to surface sediments of Lake Huron are much less than to the other lakes. Data on sedimentation rates, elemental concentrations, and natural and anthropogenic sediment inputs are given in tabular form. (Lynch-Wisconsin)
W78-02464

ANAEROBIC DECOMPOSITION OF OIL IN BOTTOM SEDIMENTS,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Environmental Resources.
T. B. Shelton, and J. V. Hunter.
Journal Water Pollution Control Federation, Vol 47, No 9, p 2256-2270, September 1975. 14 fig, 1 tab, 13 ref.

Descriptors: *Oil pollution, *Decomposing organic matter, *Dissolved oxygen, *Aerobic conditions, *Anaerobic conditions, *New Jersey, Sediment, Organic matter, Carbon, *Path of pollutants, Environmental effects, Water pollution sources, *Oil decomposition, Benzene, Elizabeth River(NJ), Woodbridge Creek(NJ).

Natural bottom sediment from the Elizabeth River and Woodbridge Creek in New Jersey, containing 8% oil on a dry weight basis, were studied to obtain an insight into the relative persistence of oils and the length of time they exert their effects on the environment. It was found that oils are lost from natural bottom sediments with time when anaerobic conditions occur in the overlying water, and that oils are more readily lost than other organic matter present. In addition it was found that there is a steady release of organic carbon with time from a natural bottom sediment containing oil with anaerobic conditions in the overlying water. This loss is greater than that obtained under aerobic conditions with the same sediment. Natural bottom sediments under anaerobic conditions consolidate under their own weight with time. Moreover, there is no observable change in the benzene extractables in a natural bottom sediment containing oil under anaerobic conditions. Finally, functional group analysis by spectrophotometry of aliphatic, aromatic, and oxy-compound fractions of oil indicated an increased loss of oxy-compounds under anaerobic conditions. (Coyle-Wisconsin)
W78-02466

THE FATE OF STORM WATER AND STORM-WATER POLLUTION IN THE PARRAMATTA ESTUARY, SYDNEY,
Snowy Mountains Engineering Corp., Cooma (Australia).
E. Wolanski.
Australian Journal of Marine and Freshwater Research, Vol. 28, No. 1, February 1977, p. 67-73. 5 fig, 15 ref.

Descriptors: *Model studies, *Storm runoff, Storm water, Water pollution sources, Estuaries, Saline water-freshwater interfaces, Hydrodynamics, Turbulence, Buoyancy, *Australia, *Upper Parramatta estuary(Australia), Sydney(Australia), Richardson number.

A simple model is proposed to trace the fate of storm water and its effects on water quality in the upper Parramatta River estuary near Sydney, Australia. Quantitative study of urban storm water pollution in this location has been difficult because the estuarine hydrodynamics of the river are complex. At least after intense rainfalls, storm water often forms a well-defined freshwater plume floating passively at the surface of the upper Parramatta estuary. As a result the Parramatta estuary is quite different from most intensively-studied estuaries, such as the Thames, Potomac or Delaware rivers. Conditions at the Parramatta call instead for a new approach to estuary modeling based on the parameterization of the interaction of turbulence and buoyance at high values of the Richardson number. Such a simple two-layer box model is proposed. Based on numerical experiments with a model it appears that the rainfall history (duration and intensity) is a very important variable controlling the fate of storm water in the upper estuary, and of the resulting storm water pollution. It is suggested that a similar parameterization of buoyancy effects could be included in a water quality model which would also accomodate lateral and longitudinal anomalous characteristics. (Harris-Wisconsin)
W78-02473

OXYGEN CONSUMPTION BY FRESHWATER SEDIMENTS,
Clemson Univ., SC. Dept. of Environment Systems Engineering.
W. S. Brewer, A. R. Abernathy, and M. J. B. Paynter.
Water Research, Vol 11, No 5, p 471-473, 1977. 3 fig, 1 tab, 8 ref.

Descriptors: *Oxygen, *Aerobic conditions, *Respiration, *Sediments, *Organic material, Sediment-water interfaces, *Biological respiration, Sediment chemistry.

A study measured the oxygen consumption rate of sediments and determined the amount of oxygen consumption attributable to biological activity. Closed systems were used to measure oxygen uptake and phenol or potassium cyanide were introduced to eliminate biological respiration. Declines in oxygen consumption in the presence of biological inhibitors demonstrated that oxygen removal by sediments from the overlying water is mainly a biological process. Reduction of rates up to 91% by poisoned samples clearly demonstrated that biological respiration was the major process removing oxygen from the overlying water. Further, the reduction--99.9%--of the aerobic bacterial population--indicated that oxygen consumption was due mainly to bacterial respiration. The study demonstrates that as the amount of available organic material increases, oxygen demand of the aerobic, heterotrophic bacteria at the sediment interface would also increase. The subsequent consequence would be an additional stress on the oxygen-poor hypolimnion. (Coyle-Wisconsin)
W78-02481

THE COMBINED RELATIONSHIP OF TEMPERATURE AND MOLYBDENUM CONCENTRATION TO NITROGEN FIXATION BY ANABAENA CYLINDRICA,
Baylor Univ., Waco, TX. Inst. of Environmental Studies.
For primary bibliographic entry see Field 5C.
W78-02483

RATES OF REMINERALIZATION AND ASSIMILATION OF UREA BY FRACTIONATED PLANKTON POPULATIONS IN COASTAL WATERS,
Queen's Univ., Belfast (Northern Ireland). Marine Biology Station.
For primary bibliographic entry see Field 5C.
W78-02484

THE IMPORTANCE OF ALLOCHTHONOUS PARTICULATE CARBON PATHWAYS IN A SUBALPINE LAKE,
Washington Univ., Seattle. Fisheries Research Inst.
For primary bibliographic entry see Field 5C.
W78-02496

NUTRIENTS IN ESTUARIES,
Marine Biological Lab., Woods Hole, MA. Ecosystems Center.
J. E. Hobbie.
Oceanus, Vol. 19, No. 5, p 41-47, 1976. 6 fig, 4 tab, 16 ref.

Descriptors: *Estuaries, *Nutrients, *Sediments, *Sediment-water interfaces, Nitrogen, Phosphorus, Photosynthesis, Aquatic plants, Runoff, Agricultural runoff, Seawater, Eutrophication, Algae, Phytoplankton, Suspended solids, Ythan River estuary(Scotland).

Seawater is rich in nutrients needed by plants, such as potassium, calcium, and magnesium; only phosphorus and nitrogen are sufficiently limited in supply to control estuarine plant growth. P and N are supplied by land runoff, erosion of older marine sediments, and seawater that comes upstream at a river's mouth. In turbid estuaries where much sediment is in suspension, there is a correspondingly high rate of exchange between sediments and water. In clear estuaries there is very little sediment-water interaction. Streams draining farmland and urban areas contain much more P and N than those draining undisturbed forest lands. A few estuaries, including the Ythan in Scotland, receive most of their nutrients from seawater. The upstream movement of bottom water and the sedimentation and coagulation of particulate matter help prevent nutrients from being washed out to sea. Nutrients move from sediments to water through the circulation of water through the upper layers of sediment and the resuspension of sediments into the water column. Both eelgrass and Spartina also pump P from the sediments into the water column. Although human activities have enriched streams feeding estuaries, phytoplankton blooms are uncommon due to the active circulation in estuaries and the ability of estuaries to deal with quantities of nutrients that would destroy the ecological balance of a lake or reservoir. Rooted plants and attached algae thrive in the nutrient-rich estuaries. (Lynch-Wisconsin)
W78-02508

POLLUTION HISTORY OF ESTUARINE SEDIMENTS,
Scripps Institution of Oceanography, La Jolla, CA.
E. D. Goldberg.
Oceanus, Vol 19, No 5, p 18-26, 1976. 6 fig, 8 ref.

Descriptors: *Estuaries, *Water pollution, *Sediments, *Pollutants, Estuarine environment, Geologic history, Radioactive dating, Lead, Chesapeake Bay, Hurricanes, Fossil fuels, Coal, Industrial wastes, Sewage effluents, Path of pollutants, Metals, Puget Sound(WA), Geochronology.

Agricultural, social, and industrial activities, as well as natural events, introduce pollutants into estuarine environments. Some of these pollutants are deposited in sediments; flow rates can be determined, particularly in anoxic deposits with high levels of organic matter. Such deposits do not support burrowing organisms which can distort or eliminate the pollution record. To ascertain the amount of a pollutant entering a deposit per unit time, the strata must be dated (geochronology) through lead-210 or other radioactive dating methods. Pollutants may be transported to the sea floor through biological activity--in fecal matter or organic remains. The primary source of lead to the environment from human activities is the combustion of lead alkyls in gasoline. Lead reaches estuaries directly from the air or from treated sewage, or indirectly via rivers or dry runoff (e.g., from lawn watering). Evidence of hurricane Agnes (1972) was found in core samples from Chesapeake Bay. Materials from fossil fuels are released to the atmosphere by burning, and enter estuaries through washout and dry fallout. The enrichment of heavy metals in the sediments is associated with coal burning. In Puget Sound (WA), sediments included arsenic and antimony from a copper smelter, and mercury from a chlor-alkali plant. DDT, PCBs, and radioactive wastes are other pollutants which can be detected in estuarine sediments. (Lynch-Wisconsin)
W78-02509

MATHEMATICAL MODELING OF DISPERSION IN STRATIFIED WATERS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
G. C. Christodoulou, J. J. Connor, and B. R. Pearce.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 091, Price codes: A14 in paper copy, A01 in microfiche. Report No NOAA-77012507, November 15, 1976. 309 p, 68 fig, 13 tab, 93 ref. MIT Sy 76-14. S6-04-5-158-1.

Descriptors: *Mathematical models, *Dispersion, *Stratification, Model studies, Summer, Thermocline, Equations, Massachusetts, Coasts, Bays, Entrainment, Finite element analysis, Analytical techniques, Effluents, *Massachusetts Bay(MA).

A mathematical model is developed for the quantitative description of the dispersion process in a two-layer representation of a natural water body during the summer, when a distinct thermocline usually exists. The purpose is to predict the spread of an effluent in a given coastal or inland body of water under strongly stratified conditions, and in this study the model is applied to Massachusetts Bay. Physical mechanisms associated with dispersion are first analyzed, and then numerical requirements for simulating the dispersion are established by the finite element method. Rational quantitative expressions for dispersion coefficients and interfacial transport in terms of mean flow characteristics are proposed. The model can handle any passive constituent, dissolved or suspended, possessing vertical mobility and arbitrary decay characteristics, in a domain of irregular geometry and bottom topography. The formulation is based on the convection-diffusion equation, vertically integrated between the layer boundaries. Verification using field experiments in Massachusetts Bay showed that the numerical model adequately predicted the dispersion process. Improvement of the model's applicability will require extension, such as treatment of vanishing bottom layers, and a reliable circulation field is essential, for which extensive field monitoring is necessary. (Lynch-Wisconsin)
W78-02511

THE INFLUENCE OF ORGANIC MATTER AND ATMOSPHERIC DEPOSITION ON THE PARTICULATE TRACE METAL CONCENTRATION OF NORTHWEST ATLANTIC SURFACE SEAWATER,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
G. T. Wallace, Jr., G. L. Hoffman, and R. A. Duce.
Marine Chemistry, Vol 5, No 2, p 143-170, 1977. 1 fig, 10 tab, 80 ref. NSF GX-33777 and GX-39147.

Descriptors: *Organic matter, *Trace elements, *Metals, *Winds, *Sea water, *Fallout, Atlantic Ocean, Carbon, Nitrogen, Aluminum, Aerosols, *Particulates, Sargasso Sea, Bermuda.

A study of factors affecting concentrations of particulate trace metals (PTMs) in the mixed surface layer of seawater offers evidence that particulate organic carbon (POC) played a dominant role in controlling particulate Cu, Zn, Pb, Cd, and to a lesser extent Ni and Cr. This was largely due to the low concentrations of alumino-silicates in open ocean and coastal surface waters. The importance of wind was also assessed through comparison of PTMs in marine aerosols collected in Bermuda over two years with Atlantic Ocean samples collected for this study between New England and Bermuda (including the Sargasso Sea). The relatively low and constant PTM concentrations in Sargasso Sea surface waters suggested wind as a significant source of PTMs. A marked similarity was noted between the enrichment factors for both water and air PTM concentrations, but a simplistic vertical model indicated that the similarity may be accidental. The probability of in-situ generation of PTM-POC associations from dissolved forms suggest that atmospheric deposition was not significant for Ni, Cr, Cu, Zn, Pb, and Cd, but that for Al, Fe, and Mn surface layer concentrations were largely a function of atmospheric deposition. Over 90% of the Cu, Zn, Pb, and Cd was apparently associated with particulate organic matter. (Lynch-Wisconsin)
W78-02512

INSECTICIDE RESIDUES ON STREAM SEDIMENTS IN ONTARIO, CANADA,
Department of Agriculture, London (Ontario). Research Inst.
For primary bibliographic entry see Field 5A.
W78-02513

THE REPORT TO CONGRESS: WASTE DISPOSAL PRACTICES AND THEIR EFFECTS ON GROUND WATER.
Environmental Protection Agency, Washington, DC. Office of Water Supply.
For primary bibliographic entry see Field 5E.
W78-02537

POSSIBLE CONTAMINATION OF GROUND WATERS BY OIL-AND GAS-WELL DRILLING AND COMPLETION FLUIDS,
Energy Research and Development Administration, Bartlesville, OK. Bartlesville Energy Research Center.
A. G. Collins.
Available from the National Technical Information Service, Springfield, VA 22161 as CONF 75051331, Price codes: A03 in paper copy, A01 in microfiche. May, 1975. 37 p, 9 fig, 8 tab, 8 ref.

Descriptors: *Groundwater, *Water pollution sources, *Drilling fluids, *Oil wells, Natural gas, Mud, Emulsions, Additives, Aquifers, Brines, Well casings, Drilling, Blowouts, *Groundwater pollution, Abandoned wells, Well cementing, Surface pits.

Drilling fluids or drilling muds are used in oil and gas well construction to remove drilled cuttings from the bottom of the hole and to maintain a hydrostatic pressure that counterbalances or exceeds formation pressures. A host of drilling mud additives are available to condition the fluid to meet the demands of a wide variety of drilling situations. The chemistry of both water-and oil-base muds poses a threat to potable water aquifers in the vicinity of a drilling site. Not only is direct contamination possible from drilling through fresh-water aquifers, but various other avenues for pollution exist, including mud and chemical spills on the surface, improper casing selection, faulty cementing jobs, improperly abandoned wells in the vicinity of the drilling sites, and blowouts. Oil field brines which are frequently used as drilling fluid make-up water are some of the most significant polluting constituents of muds. Rehabilitation of a mud-contaminated aquifer is possible in some cases, but is frequently difficult and costly. Extensive evaluation of the exact nature of the pollution and local hydrology is necessary before initiating a rehabilitation program. (Eberle-NWWA)
W78-02546

MONITORING GROUNDWATER QUALITY,
Environmental Protection Agency, Las Vegas, NV. Office of Research and Development.
For primary bibliographic entry see Field 5A.
W78-02547

AIR AND WATER CONTAMINATION BY 3,4-BENZPYRENE FROM ROAD ABRASION, (IN GERMAN),
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Hygiene und Arbeitsphysiologie.
For primary bibliographic entry see Field 5A.
W78-02562

THE SEASONAL DISTRIBUTION OR ORGANIC CARBON IN A LOUISIANA ESTUARY,
Louisiana State Univ., Baton Rouge. Dept. of Marine Sciences.
G. Happ, J. G. Gosselink, and J. W. Day, Jr.
Estuarine and Coastal Marine Science, Vol 5, No 6, p 695-705, November 1977. 2 fig, 3 tab, 29 ref.

Descriptors: *Path of pollutants, *Estuaries, *Carbon, *Organic matter, *Louisiana, Chlorophyll, Biota, Biomass, Marine biology, Marshes, Salt marshes, Plankton, Vegetation, Surveys, Sampling, Seasonal, Analytical techniques, Chemical analysis, Tidal waters, Biology, *Organic carbon, *Barataria Bay(La).

Dissolved organic carbon (DOC), total organic carbon (TOC), and chlorophyll a (CHla) were measured monthly from November 1972 to November 1973 at stations in the upper, middle, and lower areas of Caminada and Barataria bays, Louisiana, and the Gulf of Mexico. The results were used as measures of the concentration and distribution of organic detritus in the coastal waters. There was a clear gradient of organic carbon from the estuary to the Gulf of Mexico. DOC was highest in water bodies within the marshes fringing the bay, averaging 6.7 + or - 0.2 mg/l. DOC decreased towards the middle and lower bay where the average levels were 5.8 + or - 0.2 mg/l and 4.7 + or - 0.2 mg/l, respectively. The average DOC for offshore Gulf water was 2.4 + or - 0.1 mg/l. Concentrations in the bay were highest in winter and lowest in the spring, while offshore concentrations were lowest in the winter increasing toward the fall. TOC closely followed DOC. The late winter-early spring peak probably represents the washing of dead organic matter from the marsh which accompanies heavy rains and high water levels. Chl a averaged 9.7 + or - 0.98 microgram/l in Caminada Bay, 9.3 + or - 0.65 microgram/l in Barataria Bay, and 7.6 + or - 0.8 microgram/l offshore. Seasonal peaks occurred in late January (20.6 microgram/l) and July (19.2 microgram/l) in the inshore waters. Low temperature and north and easterly winds of 8-16 km/h were positively correlated with DOC. The winds could have stirred up the bottom sediments, causing correlated with DOC. The winds could have stirred up the bottom sediments, causing release of interstitial DOC into the water column. New organic carbon flux from Barataria Bay to offshore Gulf waters was calculated to lie between the extremes of 25 and 5540 gC/sq m inshore water/year, with most probable values around 150 gC/sq m/year. (Sims-ISWS)
W78-02593

INVESTIGATIONS ON DISSOLVED URANIUM, SILICON AND ON PARTICULATE TRACE ELEMENTS IN ESTUARIES,
Physical Research Lab., Ahmedabad (India).
For primary bibliographic entry see Field 5A.
W78-02595

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 8, PESTICIDES INDUSTRY,
Radian Corp., Austin, TX.
F. I. Honea.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 225, Price codes: A11 in paper copy, A01 in microfiche. Report No. EPA-600/2-77-023h, January 1977. 242 p, 30 fig, 19 tab, 7 ref, 5 append. Parsons, T. B., Ed. 1AB015ROAP 21AFH-025 68-02-1319, Task 34.

Descriptors: *Environmental effects, *Pesticides, Agricultural chemicals, Water pollution sources, Plant growth regulators, Soil contamination, Organic compounds, Chemistry, Industrial production, *Processes, Hormones.

A catalogue, developed to aid in defining the environmental impacts of U.S. industrial activity in pesticides, is presented. The pesticides industry is

considered to be that which produces organic chemicals used to control agricultural pests, to disinfect and condition soil, and to supply plant hormones. The inorganic chemicals, petroleum and creosote used as pesticides are excluded from discussion. The U.S. pesticides industry is discussed in 12 segments: simple and aromatic chlorinated hydrocarbons; diene-based; organophosphates; carbamates and thiocarbamates; triazines; anilides; ureas and uracils; nitrated hydrocarbons; other nitrogeneous; organoarsenicals and organometallics; microbial or natural derivates; and others. Thirteen chemical trees, 17 process flowsheets, and 37 process descriptions are used to describe industry activities. For each process description, available data are presented on input materials, operating parameters, utility requirements, and waste streams. Appendices contain related information on input materials, pesticide designations and producers, and 1972 pesticide production. (Wares-IPA)
W78-02615

ENVIRONMENTAL, HEALTH, AND CONTROL ASPECTS OF COAL CONVERSION: AN INFORMATION OVERVIEW: VOLUMES 1 AND 2.
Oak Ridge National Lab., Oak Ridge, TN.
For primary bibliographic entry see Field 5C.
W78-02622

A RATIONALE FOR EVALUATING THERMALLY INDUCED BIOLOGICAL EFFECTS DUE TO ONCE-THROUGH COOLING SYSTEMS,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 5C.
W78-02647

OHIO EPA WATER QUALITY STUDIES IN THE SANDUSKY RIVER BASIN,
Ohio State Environmental Protection Agency, Bowling Green. Northwest District Office.
For primary bibliographic entry see Field 5G.
W78-02649

THE PAST, PRESENT, AND FUTURE OF THE BIOSPHERE,
For primary bibliographic entry see Field 2B.
W78-02654

ENVIRONMENTAL CONTAMINATION FROM TRACE ELEMENTS IN COAL PREPARATION WASTES. A LITERATURE REVIEW AND ASSESSMENT,
Los Alamos Scientific Lab., NM.
E. M. Wewerka, J. M. Williams, P. L. Wanek, and J. D. Olsen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 339, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/7-76-007, ERDA LA-6600MS, August 1976. 69 p, 6 fig, 34 tab, 197 ref. EHB527, EPA/ERDA IAG-D5-E681.

Descriptors: *Coals, Coal mine wastes, *Trace elements, Environmental effects, Toxicity, Chemistry, Water pollution, Weathering, Leaching, Burning, Air pollution, Iron, Aluminum, Cobalt, Nickel, Manganese, Zinc, Degradation(Decomposition), Assessments, Pollution abatement, Chemical reactions, *Contaminants, Literature review, Coal preparation, Pollution sources.

A literature review and assessment project was carried out to collect and evaluate the available information on the chemistry and behavior of trace elements in coal processing wastes in order to assess the potential for environmental contamination from the trace elements in these wastes. Although only limited attention has been given previously to the chemistry of trace elements in coal waste materials, most of the growing body of knowledge concerning trace elements and minerals in raw coals can be applied directly to coal wastes. The consensus from analytical studies is that nearly every naturally occurring element is likely to be present in coal and coal refuse. The fate of these during coal preparation is poorly defined; however, large concentrations of trace elements are discarded in the washing refuse. Toxic or harmful quantities of elements, such as iron, aluminum, manganese, cobalt, nickel, and zinc, are released into the environment in the drainage from coal mineral wastes, but, in general, the behavior of trace elements during refuse weathering, leaching, and burning is not well understood. Although the literature acknowledges mineral and inorganic matter in coal wastes as a major contributor to both air and water pollution, a comprehensive assessment of the full potential for environmental contamination from the trace elements in coal preparation wastes cannot be made without the benefit of further specific applied research. (Wares-IPA)
W78-02655

GROUND-WATER CONTAMINATION: PROBLEMS AND REMEDIAL ACTIONS,
Illinois State Geological Survey, Urbana.
D. E. Lindorff, and K. Cartwright.
Environmental Geology Notes, No. 81, May 1977. 58 p, 2 fig, 3 tab, 75 ref, 1 append.

Descriptors: *Water pollution, *Groundwater, *Water pollution control, *United States, *Illinois, Wastes, Water pollution sources, Remedies, Pollutants, Mine wastes, Pollutant identification, Leachate, Groundwater movement, Landfills, Administration, Management, Administrative agencies, Decision making, Water treatment, Industrial wastes, On-site investigations, Organic wastes.

Case histories from 27 states of 116 groundwater contamination incidents reveal that remedial action is usually complex, time consuming, and expensive. Quick recognition of and response to an emergency involving groundwater are essential to minimize the spread of contamination and to make only minor remedial action necessary. However, the hydrogeologic setting and the pollution hazard at the specific locality should be assessed before corrective action is taken. The remedies most frequently used to renovate the subsurface environment include pumping and treating groundwater, removing soil, draining away groundwater via trenches, and removing the source of contamination. A combination of these techniques also has been used. Existing emergency strategies, however, are designed for coping with spills affecting surface water. No formal programs have been developed for dealing specifically with contamination of land or groundwater. Each incident has been handled as a separate problem. In Illinois, many resources are available for handling emergency pollution problems, but they are scattered among a number of state agencies. Guidelines for strategies that consider the hydrogeologic framework and administrative structure of Illinois were presented. A committee or task force should define the scope of the problem and develop a formal procedure for dealing with various kinds of land and ground-water pollution emergencies. (Humphreys-ISWS)
W78-02675

SILVER IN SOILS, STREAM SEDIMENTS, WATERS, AND VEGETATION NEAR A SILVER MINE AND TREATMENT PLANT AT MARATOTO, NEW ZEALAND,
Massey Univ., Palmerston North (New Zealand). Dept. of Chemistry, Biochemistry and Biophysics.
N. I. Ward, R. R. Brooks, and E. Roberts.
Environmental Pollution, Vol. 13, p 269-280, 1977. 4 fig, 3 tab, 15 ref.

Descriptors: *Metals, *Mining, *Mine wastes, *Treatment facilities, Soil properties, Water quality, Water pollution, Sediments, Streams, Pastures, Plant physiology, Metabolism, Fallout, Water pollution sources, Environmental effects, Distribution, Vegetation, Mode of Action, *Silver, New Zealand, Maratoto.

Silver is soils showed elevated levels near the treatment plant (due to aerial fallout), and also in natural vegetation growing over the ore deposits. Pasture soils showed silver contamination derived partly from deposition from ore trucks and partly from flooding by mineralized stream sediments. Silver in pasture species reflected the same pattern. Silver levels in leaves and trunks of Beilschmiedia tawa showed distinctly different mechanisms of uptake from aerial fall-out and natural uptake by root systems. The silver content of stream waters and stream sediments, though anomalous near the deposits and treatment plant, showed a progressive decrease with increasing distance from the source. (Klein)
W78-02700

5C. Effects Of Pollution

BIOLOGICALLY INITIATED AUTO-CATALYTIC MERCURY CONVERSION AND ITS EFFECT ON ELEMENTAL MOBILITY,
Ohio State Univ., Columbus. Dept. of Microbiology.
R. M. Pfister.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 648, Price codes: A04 in paper copy, A01 in microfiche. Ohio State University, Water Resources Center, Completion Report, April 1977. 61 p, 13 fig, 64 ref. OWRT A-042-OHIO(1).

Descriptors: *Heavy metals, Model studies, *Microorganisms, Translocation, Food chains, Aquatic populations, Sediments, Mercury, Path of pollutants, Water pollution effects, Mercury concentration, Catalytic mercury conversion.

Mercury, sometimes called quick silver, has been found in abundant quantities in various locations in the environment. An artificially induced mercury burden in the water column (due to accidental spillage) is particle associated. Whether these particles are organic or inorganic, the load carried appears related to their density. An experimental lake was established with a constant inflow and outflow and translocation of mercury in the sediments indicated an ever increasing number of microorganisms capable of methylation. This biologically initiated catalytic conversion reached equilibrium while higher organisms (fish) were still accumulating mercury. Results indicated that mercury translocation mediated via organic particulates in the model was a surface related phenomenon. Organisms (e.g. snails) feeding on surface material high in mercury pick up mercury at an increased rate. This material was primarily biologic in nature and consisted of an algal mass with many protozoa.
W78-02201

BIOLOGICAL AND WATER QUALITY EFFECTS OF WHOLE LAKE MIXING,
Oklahoma State Univ., Stillwater. School of Biological Sciences.
For primary bibliographic entry see Field 5G.
W78-02203

ENVIRONMENTAL POLLUTION BY HEAVY METALS,
J. Cook.
International Journal of Environmental Studies, Vol 9, No 4, p. 253-266, 1977. 2 fig, 3 tab.

Descriptors: *Heavy metals, *Environmental effects, Cadmium, Mercury, Lead, Effluents, Industrial wastes, Pollution abatement, Strontium radioisotpoes, Radioactivity, Metals, Waste treatment policy(United Kingdom).

A paper describing environmental pollution by heavy metals such as cadmium, lead, and mercury, covers comparative effects on the environment of radioactive and nonradioactive metals, describes health hazards involved in heavy metals pollution, and discusses ways to reduce pollution through treatment and recycling of industrial wastes and effluents. In addition to well-documented environmental effects of radioactive elements such as strontium-90, cesium-137, iodine-131 and barium-140, a serious and growing problem is seen in the deposition of nonradioactive heavy metals in many niches of the environment. Nonradioactive heavy metals contaminate the atmosphere, bodies of water, and land via industrial wastes. It is now recognized that many lower organisms take up and concentrate heavy metals and other pollutants. Cadmium may have more lethal possibilities than any other metal. It tends to occur as a pollutant in the vicinity of zinc smelters, where it may comprise 20% of the distillate from dust in the furnace receivers. The yearly average value of cadmium in air in the U.S. is 0.002 micrograms/sq m. Lead is released into the environment at an annual rate of about 210,000 tons. The major source of human lead intake is food (100-500 micrograms per day); about 90% of this amount is excreted. Burning fossil fuels injects about 5k000 tons of mercury each year into the atmosphere. Most of this ends up in the sea, which receives a similar amount from industrial wastes. (Lynch-Wisconsin)
W78-02215

SOME ECONOMIC AND ENVIRONMENTAL EFFECTS OF HIGHWAYS IN JAPAN AND THE UNITED STATES,
Federal Highway Administration, Washington, D.C. Transportation Economics Div.
F. I. Thiel, and A. Kane.
Traffic Quarterly, Vol. 31, No. 3, p. 399-419, July 1977. 7 fig, 1 tab.

Descriptors: *Environmental effects, *Highway effects, *United States, *Highways, *Planning, *Land use, *Japan, *Citizen participation, Noise barrier walls, Vehicles.

A study of economic and environmental effects of highways in Japan and the United States emphasizes differences rather than similarities. Reviewed in detail are Japanese toll structures, the planning process for expressways, study approaches, roadway design, types of vehicles using the highways, and special vehicle equipment. Citizen participation in the planning process is compared, noting that the Japanese are hesitant of drawing in citizens at an early stage in the planning process because of resulting delays. Japan also lacks a technical citizen participation process permitting evaluation of various alternatives. Deleterious environmental effects of highways in Japan appear responsive to problems which may preclude legalistic remedies. Similarities are noted in study approaches used in the two countries and solutions to development problems are outlined. Both countries need better land use controls along highways and better monetary quantification of the accessibility and proximity effects of highways. (Coyle-Wisconsin)
W78-02221

INTERACTION OF SOLUBLE PHOSPHATE WITH ALUMINUM HYDROXIDE IN LAKES,
Wisconsin Univ.-Madison. Dept. of Soil Science.
M. G. Browman, R. F. Harris, D. E. Armstrong, and G. Chesters.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 571, Price codes: A05 in paper copy, A01 in microfiche. Wisconsin Water Resources Center, Madison, Technical Report, WIS WRC 77-05, June 1977. 79 p, 14 fig, 12 tab, 34 ref. OWRT B-088-WIS(3), 14-31-0001-4140.

Descriptors: *Phosphorus, Lakes, *Eutrophication, *Algae, *Chemicals, *Metals, Nutrients, *Aluminum hydroxide, Productivity, Water pollution effects, Sediments, *Snake Lake(Wisc), Pickerel Lake(Wisc), *Lake renewal.

Criteria were defined for predicting the short and long term potential effectiveness of aluminum hydroxide treatment for reversing lake eutrophication by reducing the phosphorus status of the lake photic zone to levels limiting algal productivity. The basic approach was an examination of the interactions of added aluminum with various phosphorus compartments in the lake as related to the direct removal of dissolved inorganic phosphorus in the photic zone from other forms of phosphorus and other zones of the lake. Aspects of aluminum treatment examined experimentally were the ability of an aluminum hydroxide floc to (1) remove dissolved inorganic phosphorus and other forms of phosphorus from water, (2) maintain its inorganic phosphorus-sorptive capacity upon aging in different lake environments, and (3) retard movement of inorganic phosphorus from anaerobic sediments to the overlying water. These aspects were examined individually and then in an integrated fashion in sediment-water columns. Success of aluminum hydroxide treatment is good provided (1) external sources of phosphorus are relatively small or are reduced concurrent with aluminum treatment, (2) particulate phosphorus and 'dissolved' organic phosphorus levels are not high at the time of treatment, (3) the aluminum dosage is increased where local epilimnetic and hypolimnetic inorganic phosphorus concentrations demand and (4) the aluminum treatment is increased and a fairly even distribution of floc on the top sediment is achieved eliminating 'bare' spots on the sediments. (Diamantis-Wisconsin)
W78-02222

AVAILABILITY AND CONCENTRATION OF POLLUTANTS FROM AMERICAN FALLS RESERVOIR SEDIMENTS TO FORAGE AND PREDACEOUS FISHES,
Idaho State Univ., Pocatello.
For primary bibliographic entry see Field 5B.
W78-02265

THE LAKE TROUT OF TWIN LAKES, COLORADO,
Colorado Cooperative Fishery Unit, Fort Collins.
For primary bibliographic entry see Field 8I.
W78-02269

ECOLOGY OF MYSIS RELICTA IN TWIN LAKES, COLORADO,
Colorado Cooperative Fishery Unit, Fort Collins.
For primary bibliographic entry see Field 8I.
W78-02270

FOREWORD, OZONE SYMPOSIUM,
Air Products and Chemicals, Inc., Allentown, PA.
For primary bibliographic entry see Field 5D.
W78-02329

INVESTIGATION OF MUTAGENIC EFFECTS OF PRODUCTS OF OZONATION REACTIONS IN WATER,
Environmental Protection Agency, Washington, DC. Office of Water Supply.
For primary bibliographic entry see Field 5F.
W78-02378

DOES POLLUTION ABATEMENT IMPROVE AQUATIC LIFE,
Normandeau Associates, Bedford, NH.
For primary bibliographic entry see Field 5B.
W78-02390

AGAT SEWAGE TREATMENT PLANT: IMPACT OF SECONDARY TREATED EFFLUENT ON GUAM COASTAL WATERS,
Guam Univ., Agana. Water Resources Research Center.
R. T. Tsuda, and D. A. Grosenbaugh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 857, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No. 3, October 1977. 39 p. 4 fig, 8 tab, 15 ref. OWRT A-003-GUAM(1), 14-31-0001-5054.

Descriptors: *Sewage effluents, *Phosphates, *Coliform, Biota, Algae, Fish, Coral, Zooplankton, Nitrates, Waste water treatment, *Treatment facilities, *Water pollution effects, Nutrients, *Guam, Coastal waters.

This study characterizes the effluent and provides information on the impact of a secondarily treated sewage effluent on Guam coastal waters and reef biota. Nutrient levels of effluent are high, with reactive phosphate varying between 170 and 400 microgram-at./l and nitrate-nitrogen ranging from 10 to 530 microgram-at./l. Forty-six of 67 fecal coliform samples obtained from the effluent were less than 200 counts per 100 ml. Chlorine levels in the treatment tank varied between 0.2 and 4.0 ppm. The effluent discharged in 2.4 m of water rises immediately to the surface. Surface phosphate levels are reduced to one third of that originating at the point of discharge. Upon reaching the surface, the fate of the effluent depends on wind, wave, and current conditions existing at any given time. The additional nutrient input from the sewage to the marine environment has little effect on the benthic biotas, since the nutrients are carried directly to the surface. Zooplankton, per unit volume displaced, are consistently higher in the control sample obtained from an area south of the outfall just off the reef platform.
W78-02398

A COMPARISON OF THE EFFECTS OF CHELATED AND NON-CHELATED CADMIUM ON THE SPECIFIC GROWTH RATE OF SELENASTRUM CAPRICORNUTUM,
Oklahoma State Univ., Stillwater. Reservoir Research Center.
D. Parrish, and S. L. Burks.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 775, Price codes: A02 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Stillwater, Completion Report, (1977). 13 p, 1 tab, 17 ref. OWRT A-073-OKLA(1).

Descriptors: *Bioassay, *Cadmium, *Chelation, Chlorophyta, *Growth rates, *Phytotoxicity, Water pollution effects, Aquatic algae, *Algal assay, Bioaccumulation, EDTA, *Selenastrum capricornutum.

A modification of the U.S. Environmental Protection Agency's Algal Assay Procedure was used to determine the effect of chelation on cadmium toxicity to Selenastrum capricornutum Printz. Specific growth rates and bioaccumulation were measured. No differences in growth rate compared to the controls occurred in cultures treated with 2 to 10 micro-g/l cadmium. No growth was observed in cultures treated with 0.2 to 5.0 mg/l cadmium. Bioaccumulation of 2 to 20 micro-g/l cadmium in 60ml cultures in five days was below the detection limit of flame atomic absorption for cadmium.
W78-02399

DETECTION OF A POTENTIAL HEALTH HAZARD IN RECREATIONAL AND OTHER SURFACE WATERS,
Nebraska Univ. at Omaha. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W78-02405

FACTORS AFFECTING THE AVAILABILITY OF SEDIMENT-BOUND CADMIUM TO THE ESTUARINE, DEPOSIT-FEEDING CLAM, MACOMA BALTHICA,
Geological Survey, Menlo Park, CA. Water Resources Div.
S. N. Luoma, and E. A. Jenne.
In: Proceedings of the Fourth National Symposium on Radioecology, held at Corvallis, Oregon, May 12-13, 1975; Special Publication No 1, Ecological Society of America, p 283-290, 1976. 4 fig, 2 tab, 20 ref.

Descriptors: *Cadmium, *Bottom sediments, *Food chains, *Clams, Estuarine environment, Benthos, Sampling, Analytical techniques, Evaluation, Water pollution effects, *San Francisco Bay(Calif).

The uptake of Cd-109 by the deposit-feeding clam, Macoma balthica, varied significantly among several types of sediments. To directly estimate the amount of Cd-109 taken up through ingestion of sediment, experimental techniques were developed for determining the gut content of labeled sediment and the contribution of solute Cd-109 to the total body burden of the nuclide in the clams. No detectable uptake of Cd-109 occurred through ingestion of either labeled organic detritus of particulate hydrous-iron oxide which had been coprecipitated with the nuclide and coated with organic material. Detectable uptake of Cd-109 was observed when clams were exposed to either hydrous-iron oxide particulates which lacked the organic coating or San Francisco Bay sediment labeled with the nuclide. Uptake of Cd-109 through ingestion of labeled sediment was relatively inefficient for all sediment types. Apparent steady-state concentrations of Cd-109 in the clam were never greater than 10% of the concentration of the nuclide in any type of sediment studied. The results from several preliminary chemical extractions of sediments indicate that the amount of Cd-109 removed by selected extractants does not correlate in a simple manner with the bioavailability of this trace metal. (Woodard-USGS)
W78-02427

EVALUATION OF CHEMICAL, BIOLOGICAL, AND PHYSICAL CONDITIONS IN THE WINTER HAVEN CHAIN OF LAKES, FLORIDA, MARCH-JUNE 1976,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5A.
W78-02435

AQUATIC ORGANISMS FROM SELECTED SITES ALONG THE TRANS-ALASKA PIPELINE CORRIDOR, SEPTEMBER 1970 TO SEPTEMBER 1972 - SUPPLEMENT,
Geological Survey, Anchorage, AK. Water Resources Div.
J. W. Nauman, and D. R. Kernodle.
Open-file report 77-634 (basic data), 1977. 55 p, 1 fig, 4 tab, 15 ref.

Descriptors: *Water quality, *Benthic fauna, *Invertebrates, *Alaska, *Pipelines, Oil, Surface waters, Data collections, Aquatic life, Systematics, Classification, Varieties, Baseline studies, *Trans-Alaska pipeline corridor, Aquatic organisms, Taxa.

This report is a supplement to earlier preconstruction studies of benthic invertebrates and water quality at selected sites along the trans-Alaska pipeline corridor. Some of the problems which arose during the course of data collection and analysis are discussed. Benthic invertebrate abundance and community-structure data are presented for 20 sites along the trans-Alaska pipeline for the period September 1970 to September 1972. In addition, a list of invertebrate taxa identified to various taxonomic levels is given for 42 sites along the pipeline. (See also W74-08369) (Woodard-USGS)
W78-02437

CONCENTRATION FACTORS AND TRANSPORT MODELS FOR RADIONUCLIDES IN AQUATIC ENVIRONMENTS. A LITERATURE REPORT,
Environmental Monitoring and Support Lab., Las Vegas, NV.
R. G. Patzer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 097, Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA-600/3-76-054, May 1976. 56 p, 1 fig, 10 tab, 72 ref.

Descriptors: *Aquatic environment, *Water pollution effects, *Environmental control, Freshwater, Invertebrates, Fish, Food chains, Human population, Risks, Estimating, Mathematical models, Monitoring, Effects, Bibliographies, *Radionuclides, Literature review, Biological concentration, Aquatic organisms, Marine environment, Waste discharge, Order of magnitude.

The relative risks to man from radionuclides released to the environment depend heavily on their accumulation or concentration in aquatic organisms. The organisms which accumulate those radionuclides present in the environment may be useful as indicators for environmental monitoring purposes. In addition, these organisms may be directly in food chain pathways to humans. Herein, literature is reviewed and summarized in regard to biological concentration of radionuclides in freshwater and marine environments. Concentration factors for elements found in organisms are tabulated for plants, invertebrates, and fish in marine and freshwater environs. Literature is also reviewed on models developed to calculate the possible radiatin dose delivered to humans from radionuclides released into aquatic environments. The model approaches summarized range from simple generalized forms which, at best, give order of magnitude estimates to detailed models for a specific area which may be used to guide waste discharge practices. (Bell-Cornell)
W78-02452

EFFECT OF WASTEWATER SLUDGE ON SOIL MOISTURE RELATIONSHIPS AND SURFACE,
Wisconsin Univ.-Madison. Dept. of Soil Science.
K. A. Kelling, A. E. Peterson, and L. M. Walsh.
Journal Water Pollution Control Federation, Vol 49, No 9, p 1698-1703, July 1977. 2 fig, 1 tab, 16 ref. UW 1602 1921.

Descriptors: *Infiltration rates, *Runoff, *Soil moisture, Sludge, Moisture content, Phosphorus, Nitrogen, Wisconsin, Sludge disposal, Soils, *Liquid sludge.

Applications of digested waste water sludge can favorably affect soil moisture holding capacity, aggregation, porosity, bulk density and permeability. Productivity of both coarse testured and fine testured soils can be increased. This study was undertaken to clarify the effect of liquid sludge on soil moisture content and infiltration, and the relative sediment, nitrogen and phosphorus content of runoff as influenced by rate of sludge application and time after treatment. Field applications of liquid digested waste at rates up to 20 cm (60 metric tons dry solids/ha) significantly increased soil moisture and, under certain circumstances, infiltration. Sludge applications influenced the soil moisture regime for at least two years. Measurements with a spinkling infiltrometer showed that surface runoff from sludge treated areas contained increased amounts of inorganic nitrogen whereas seiment load and organic nitrogen in the rnoff were somewhat reduced by the sludge applications probably because of increased infiltration and improved aggregation. Significantly more dissolved ortho phosphorus and total phosphorus were contained in the runoff water from the sludge treated areas. (Coyle-Wisconsin)
W78-02454

SEASONAL PATTERNS IN ACIDITY OF PRECIPITATION AND THEIR IMPLICATIONS FOR FOREST STREAM ECOSYSTEMS,
Forest Service (USDA), Durham, NH. Northeastern Forest Experiment Station.
J. W. Hornbeck, G. E. Likens, and J. S. Eaton.
Water, Air, and Soil Pollution, Vol 7, No 3, p 355-365, March 1977. 5 fig, 1 tab, 13 ref.

Descriptors: *Precipitation(Atmospheric), *Acidity, *Hydrogen ion concentration, *Streamflow, New York, Pennsylvania, New Hampshire, Seasonal, *Hubbard Brook Experimental Forest(NH).

Data collected since 1965 at eight stations in New York and Pennsylvania and one in central New Hampshire show that precipitation is mostly acidic in the growing season--May through September--and least acidic in winter-December through February. The New York and Pennsylvania stations are part of a U.S. Geological Survey (USGS) network. The Hubbard Brook Experimental Forest station in New Hampshire is operated by the U.S. Forest Service. USGS stations were used only to determine the existence and extent of seasonal patterns in acidity. Hubbard Brook was studied in greater detail for causes and implications of seasonal patterns. Precipitation at the Hubbard station is decidely more acid in the summer, although the hydrogen ion concentration is lowered as precipitation passes through the forest canopy. Acidity of precipitation in spring and autumn is intermediate between summer and winter values. In the absence of a leaf canopy or snowpack, the acidity of precipitation entering the soil during spring and autumn may be higher. However the streamflow acidity shows little effect, remaining fairly constant year round. (Coyle-Wisconsin)
W78-02455

EFFECTS OF ACID MINE WASTES ON AQUATIC ECOSYSTEMS,
Southern Illinois Univ. at Carbondale. Dept. of Botany.
J. D. Parsons.
Water, Air, and Soil Pollution, Vol 7, No 3, p 333-354, March, 1977. 16 fig, 44 ref.

Descriptors: *Strip mine lakes, *Strip mines, *Acid mine water, *Acidic water, *Water pollution effects, *Water quality, *Persistence, Fish, Plankton, Benthos, Missouri, Environmental effects, Artificial lakes, *Cedar Creek Basin, *Long-term environmental effects.

The Cedar Creek Basin in central Missouri was studied during a 26-month period ending August 1954 to observe effects of continuous and periodic acid effluent flows on aquatic communities. Acid strip mine effluent was toxic to many aquatic organisms. In areas of Cedar Creek subjected to continuous acid flow, planktonic and benthic species had become adapted to the severe conditions and varied in abundance and diversity. No fishes were observed in the continuous acid effluents areas. Downstream where periodic mineral acid conditions changed drastically during an excessive effluent flow, planktonic and benthic communities had high diversity but low density. Fish populations were variable in this stream reach. The chemical basis of water quality variability was shown to be time-related and statistically-related to the aquatic communities. A cursory series of aerial and ground observations made ten years later noted chevron red lakes were still reddish-black and acid, while the single parallel lake was natural in appearance and supported submergent vegetation. (Coyle-Wisconsin)
W78-02456

ENVIRONMENTAL PHOSPHORUS HANDBOOK.
For primary bibliographic entry see Field 5B.
W78-02457

THE ACUTE TOXICITY OF 47 INDUSTRIAL CHEMICALS TO FRESH AND SALTWATER FISHES,
Battelle Pacific Northwest Labs., Richland, WA. Water and Waste Management Section.
G. W. Dawson, A. L. Jennings, D. Drozdowski, and E. Rider.
Journal of Hazardous Materials, Vol 1, No 4, p 303-318, March 1977. 4 tab, 16 ref.

Descriptors: *Fish, *Toxicity, *Chemicals, *Industrial production, Water pollution, Pollutants, Water quality standards, Sunfishes, Regulation, Federal Water Pollution Control Act, Fishkill, Federal Water Pollution Control Act Amendments of 1972(PL 92-500), Bluegill sunfish, Lepomis macrochirus, Tidewater silversides, Menidia beryllina.

Forty-seven industrial chemicals were tested for toxicity to freshwater fish (bluegill, sunfish, Lepomis macrochirus) and saltwater fish (tidewater silversides, Menidia beryllina) to assist the EPA in designating hazardous substances under the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500). The proposed median lethal concentration (50% mortality after 96 hours, or 96-hour LC50) for aquatic animals is 500 mg/l. Twenty-nine of the substances clearly qualify as hazardous under the proposed criteria. Three additional substances were toxic under 500 ppm only to saltwater fish, but still qualify as hazardous. The remaining 15 substances were well above the proposed criteria. Tables present the test results. All fish were held in all-glass 30-gal aquaria, and tested in 5-gal aquaria. Potable well water was used in the freshwater tests; pH was 7.6-7.9, and hardness was 55 mg/l (as CaCO3). If, after addition of the toxicant, dissolved oxygen was being depleted rapidly, aeration was initiated. For saltwater tests a synthetic sea salt mix was added to the well water until the specific gravity was 1.018. No anomalous results were evident between the two species for any substance. The greatest variation was for tetramethyllead in which the freshwater LC50 value was 6.2 times greater than that for saltwater. (Lynch-Wisconsin)
W78-02463

IMPACTS OF MAN'S ACTIVITIES ON THE CHEMICAL COMPOSITION IN THE SEDIMENTS OF LAKES ONTARIO, ERIE AND HURON,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W78-02464

A METHOD OF STUDYING PHOTOSYNTHETIC CAPACITIES IN UNICELLULAR ALGAE BASED ON IN VIVO CHLOROPHYLL FLUORESCENCE,
Umea Univ. (Sweden). Dept. of Plant Physiology.
For primary bibliographic entry see Field 5A.
W78-02467

THE PROBLEM OF THE SANITARY PROGNOSIS OF THE WATER QUALITY OF THE NIZHNEKAMSK RESERVOIR, (IN RUSSIAN),
Kazan Inst. of Porsgraduate Medicine (USSR).
L. N. Krepkogorskii, Y. N. Pochkin, N. B. Sorokina, and T. P. Devyatkova.
Gig Sanit 10, p 19-22, 1976.

Descriptors: *Water quality, Reservoirs, Bioindicators, Water analysis, Pollutant identification, *USSR(Nizhnekamsk Reservoir).

On the basis of analyses of the indices of the Nizhnekamsk reservoir (Russian SFSR, USSR), the hygienic significance of its water composition prognosis was substantiated with a usage of 95% of the amount supplied. The filed investigations were carried out in the rainiest years.--Copyright 1978, Biological Abstracts, Inc.
W78-02468

MICROBIOLOGICAL STUDIES OF THE WANDA LAKE (ANTARCTICA), (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Inst. Mikrobiologii.
A. E. Kriss, I. N. Mitskevich, E. P. Rozanova, and L. K. Osnitskaya.
Mikrobiologiya 45(6), p 1075-1081, 1976.

Descriptors: *Microbiology, *Antarctica, *Wanda Lake(Antarctica), Lakes, Isolation, Bacillus, Chromobacterium, Mycobacterium, Photosynthesis, Pseudomonas, Salinity, Saprophytes, Sulfates, Yeast.

The deep-water (68 m) Wanda lake in Antarctica has 3 characteristics: a relatively high temperature in the bottom layer, elevated salinity and the presence of HzS. Only several (less often, dozens) saprophytic microorganisms per 40 ml of water are encountered in the lake. The total number of bacteria varies from 6 x 10 to the 3rd power to 172 x 10 to the 3rd power cell/ml. The highest content of the total bacterial population, and saprophytes, is found in intermediate layers, 30 and 40- 50 m deep, respectively. Microbial strains isolated from water and ooze belong to the genera Pseudomonas, Chromobacterium, Bacillus, and Mycobacterium. Yeast organisms were also found. Sulfate reducing bacteria could not be detected only at 1 station in ooze of the lake while thionic bacteria could not be determined at all. Photosynthetic bacteria were isolated from ooze at all 4 stations.--Copyright 1978, Biological Abstracts, Inc.
W78-02469

THE RATE OF GROWTH AND PRODUCTION OF BACTERIOPLANKTON IN THE VOLGA, (IN RUSSIAN),
Gorkii State Univ. (USSR).
T. N. Tarasova.
Mikrobiologiya 45(6), p 1082-1086, 1976.

Descriptors: *Growth rates, *Bacteria, Plankton, *Bacterioplankton, USSR(Volga River), Biomass, Seasonal.

The time of generation and production of bacteria were assayed in the Volga river (USSR). The time of generation of bacterioplankton was about 35.6-62.1 h/season during different years. The mean daily production of bacteria during a season was 30-50% of the biomass. The duration of vial exposition for estimating the time of generation and production was determined experimentally for conditions of the Volga.--Copyright 1978, Biological Abstracts, Inc.
W78-02470

EFFECT OF SOME POLLUTANTS ON THE FILTRATION RATE OF MYTILUS,
Newcastle-upon-Tyne Univ. (England). Dept. of Civil Engineering.
P. D. Abel.
Marine Pollution Bulletin, Vol. 7, No. 12, p 228-231, December 1976. 2 fig, 1 tab, 16 ref.

Descriptors: *Water pollution effects, *Mussels, *Feeding rates, Respiration, Laboratory tests, Analytical techniques, *Copper, *Zinc, *Mercury, *Sulfides, Toxicity, Estuarine environments, *Feeding filtration rates(Mussels), *Cyanide, *Thiocyanate.

Effects of six pollutants (copper, zinc, mercury, cyanide, thiocyanate and sulfide, on the feeding filtration rate of the mussel Mytilus edulis were studied and their effective concentrations compared with results of conventional, but more time-consuming lethal toxicity tests. Lethal toxicity tests showed that the concentrations of copper lethal to Mytilus edulis were: 7 day LC50 0.2 mg/l, 9 day LC50 0.3 mg/l, and 7 day LC50 0.3 mg/l. Results of the filtration rate measurements (96 h LC 0.28 mg/l and 7 day LC 0.26 mg/l) stand in agreement with results of the lethal toxicity tests. According to both techniques, pollutants follow the expected general pattern of toxic behaviour-cyanide being more toxic than thiocyanate, and among the metals tested, mercury being the most and zinc the least toxic. Comparison of results of the lethal toxicity and filtration rate measurements suggest that the latter gives reliable indication of toxic effect, and that as a technique for testing pollutant effectiveness it is comparable or superior in sensitivity to the more time-consuming and elaborate procedure. (Harris-Wisconsin)
W78-02471

BASELINE LEVELS OF BENZO(A)PYRENE IN SOUTHERN CALIFORNIA MUSSELS,
British Columbia Univ., Vancouver. Dept. of Zoology.
B. P. Dunn, and D. R. Young.
Marine Pollution Bulletin, Vol. 7, No. 12, p 231-233, December 1976. 1 fig, 2 tab, 13 ref.

Descriptors: *Baseline studies, *Mussels, *Bioindicators, California, Human pathology, Human diseases, Oil spills, Organic compounds, Sea water, Pacific Ocean, Oil pollution, Water pollution sources, Water pollution effects, *Benzo(a)pyrene, Carcinogens, Mytilus edulis, Mytilus californianus, Chlorinated hydrocarbons.

A survey of levels of benzo(a)pyrene in mussels from 19 mainland and six island stations situated in the Southern California Bight was conducted to establish baseline values for the contamination of coastal waters by this carciogenic substance originating in either natural or artificial petreoluem oil accumulations. The mussel Mytilus californianus was preferred for the survey. However, where unobtainable, Mytilus edulis was sampled. Generally, mussels were obtained from locations at least 1 km from the nearest pier. In some cases, however, only mussels growing directly on pilings could be obtained. The survey showed little evidence of contamination. At both mainland and island stations, levels of contamination in mussels taken from locations of at least 1 km from piers was at or near the detection limit of 0.1 micrograms/kg. Mussels growing on pilings and near large harbors had elevated (B(a)P) levels. The highest (B(a)P) level was found in mussels growing on a neo-creosoted subsrate on the San Gabriel river breakwater (2.3 micrograms/kg). The next highest (B(a)P) level (1.4 microgram/kg) was found near the western end of the San Pedro harbor breakwater, with mussels from the adjacent stations also showing elevated (B(a)P) levels (0.5 micrograms/kg, station 10; and 0.6 microgram/kg, station 12). Mytilus californianus tended to show lower (B(a)P) levels than Mytilus edulis. (Harris-Wisconsin)
W78-02472

THE FATE OF STORM WATER AND STORMWATER POLLUTION IN THE PARRAMATTA ESTUARY, SYDNEY,
Snowy Mountains Engineering Corp., Cooma (Australia).
For primary bibliographic entry see Field 5B.
W78-02473

RATES OF DIRECT PHOTOLYSIS IN AQUATIC ENVIRONMENT,
Environmental Research Lab., Athens, GA.
For primary bibliographic entry see Field 5A.
W78-02474

EFFECT OF FERTILIZERS ON THE NUMBER OF BACTERIA INVOLVED IN THE NITROGEN CYCLE IN POND WATER OF THE ASTRAKHAN OBLAST, (IN RUSSIAN),
Kaspiiskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Astrakhan (USSR).
K. V. Gorbunov, and A. F. Sokolskii.
Mikrobiologiya 45(5), p 888-893, 1976.

Descriptors: *Fertilizers, *Bacteria, *Nitrogen cycle, Phosphorus, Ponds, Reeds, Spawning, *USSR(Astrakhan Oblast).

Reed intensification affects the distribution of bacteria involved in turnover of N in pond water. Green fertilizers (reed) stimulate the number of N-fixing bacteria and the number and activity of nitrifying bacteria to a higher degree than N and P fertilizers. Reed is recommended as the main means for spawning pond intensification in the Astrakhan Region, USSR.--Copyright 1978, Biological Abstracts, Inc.
W78-02475

STUDIES ON PRIMARY PRODUCTION IN THE GREEN GIRDLE OF NEUSIEDLER LAKE: I. CAREX RIPARIA CURT, (IN GERMAN),
Vienna Univ. (Austria). Pflanzenphysiologishches Inst.
R. Maier.
Pol Arch Hydrobiol 23(3), p 377-390, 1976.

Descriptors: *Primary productivity, Lakes, *Reeds, *Neusiedler Lake(Austria), Standing crops, Reed harvesting, Biomass, Caricetum-acutiformis-ripariae, Crops, Summer.

The primary production of C. riparia in a Caricetum acutiformis-ripariae association on Neusiedler Lake (Austria) was investigated via a harvesting method. C. riparia shows highest density in an area without inundation but of high wetness. In comparison with temporarily half-submerged Carices in inundation zones the plants of the wetland are smaller and have a lower fresh and dry weight (DW). The production of the sedge is higher where no industrial reed-harvesting takes place, and the maximum of measured standing crop is 400.0 g DW, with regularly harvested stands 168.3 g DW. The standing crop:underground biomass relation in the temporarily flooded area is about 70:30 (summer).--Copyright 1978, Biological Abstracts, Inc.
W78-02476

RECOVERY OF AQUATIC BACTERIAL POPULATIONS IN A STREAM AFTER CESSATION OF CHEMICAL POLLUTION,
Texas Univ. Health Science Center, Houston. School of Public Health.
For primary bibliographic entry see Field 5G.
W78-02477

PHOSPHATE AND SILICATE GROWTH AND UPTAKE KINETICS OF THE DIATOMS ASTERIONELLA FORMOSA AND CYCLOTELLA MENEGHINIANA IN BATCH AND SEMICONTINUOUS CULTURE,
Michigan Univ., Ann Arbor. Div. of Biological Sciences.
D. Tilman, and S. S. Kilham.
Journal of Phycology, Vol. 12, No. 4, p. 375-383, 1976. 6 fig, 2 tab, 25 ref. NSF GB-41315.

Descriptors: *Diatoms, *Phosphates, *Silicates, *Kinetics, Phytoplankton, Nutrients, Model studies, Analytical techniques, Plant growth, Growth rates, Adsorption, *Asterionella formosa, *Cyclotella meneghiniana.

To test the hypothesis that interspecific competition for nutrients determines phytoplankton species composition and seasonal succession in lakes, it is necessary to have data on relationships between external nutrient concentration, nutrient supply rate, internal nutrient concentration, and growth rates. This paper reports phosphate and silicate nutrient kinetic information for two freshwater diatom species, Asterionella formosa and Cyclotella meneghiniana. Two experimental and theoretical approaches were used to determine if comparable results would be obtained. Short-term batch cultures were fit to the Monod growth model, and long-term seimcontinuous cultures and short-term uptake experiments were fit to the variable internal stores model. The qualitative results of the two methods agreed. For limiting phosphate experiments, A. formosa was better able to grow at low extracellular PO4-P concentrations than C. meneghiniana, and is almost one order of magnitude more efficient at using internal phosphate for growth. C. meneghiniana is more efficient at using intracellular silicate for growth than A. formosa. For short-term batch culture, the half saturation constant for SiO2-Si-limited growth for C. meneghiniana was less than for A. formosa. In nutrient uptake experiments, there was no significant differences between the two species in half saturation constants for either phosphate or silicate. (Lynch-Wisconsin)
W78-02478

EFFECTS OF ATHENS POLLUTION OUTFALLS ON MARINE FAUNA OF THE SARONIKOS GULF,
Durham Univ. (England). Dept. of Botany.
C. R. C. Sheppard.
International Journal of Environmental Studies, Vol. 11, No. 1, p. 39-43, 1977. 3 fig, 1 tab, 9 ref.

Descriptors: *Oil pollution, *Wastes, *Water pollution, Gulfs, International commissions, *Saronikos Gulf(Aegean Sea), *Athens(Greece).

The Saronikos Gulf, offshore of Athens, Greece in the Aegean Sea, receives a considerable load of untreated waste discharges from that city. Pollution in this gulf is the subject of a multidisciplinary study sponsored by Greece, the World Health Organization and the United Nations Development Program. A survey of 10 sublittoral Gulf sites shows a marked response by benthic fauna to the pollution greatly reduced community diversity, coupled with massive increases of certain pollution-tolerant, suspension feeding species indicates a stressed ecosystem in the north of the Gulf. Near the industrially-polluted regions a marded overall loss of species and diversity occurs. A few species appear to tolerate pollution and exploit it as a food source as is shown by the dominance and relative abundance of these animals. This seems to be the case also with phytoplankton and zooplankton. Selective and gross mortalities of marine species and state of anoxia which were previously confined to small areas appear to be spreading to large and more open parts of the Gulf. (Coyle-Wisconsin)
W78-02479

SOME EFFECTS OF NITROGEN-STARVATION OF NITROGEN AND CARBOHYDRATE METABOLISM IN ANKSTRODESMUS BRAUNII,
University Coll. of Swansea (Wales). Dept. of Botany and Microbiology.
C. R. Hipkin, and P. J. Syrett.
Planta, Vol. 133, No. 3, p 209-214, 1977. 3 fig, 35 ref.

Descriptors: *Photosynthesis, *Enzymes, *Algae, Protein, Chlorophyll, Water pollution effects, *Metabolism, Carbohydrates, *Ankistrodesmus braunii, *Nitrogen starvation.

Enzymic activities were measured in cell-free extracts from nitrogen-starved cultures of Ankistrodesmus braunii. Over a 10-hour period of nitrogen starvation, the activities of the enzymes nitrite reductase, glutamic dehydrogenase, glutamine synthetase and urea amidolyase were derepressed. Activities of the enzymes malate dehydrogenase and hexokinase remained more or less unchanged. In contrast, phytosynthetic capacity of the nitrogen starved cultures dropped rapidly. Accompanying the decline were losses in activities of ribulose dephosphate carboxylase and triose phosphate-dehydrogenase. Nitrogen starvation does not lead to a stable condition in such algae but instead induces rapid changes in the quality and quantity of cellular biochemicals, particularly enzymes. Protein turnover must be rapid under these conditions and perhaps intracellular proteinase activity increases in algae in response to nitrogen starvation. It is proposed that losses in photosynthetic enzyme activities are the principal cause of the initial losses in photosynthetic activity in nitrogen starved algae. (Coyle-Wisconsin)
W78-02482

THE COMBINED RELATIONSHIP OF TEMPERATURE AND MOLYBDENUM CONCENTRATION TO NITROGEN FIXATION BY ANABAENA CYLINDRICA,
Baylor Univ., Waco, TX. Inst. of Environmental Studies.
R. Jacobs, and O. Lind.
Microbial Ecology, Vol. 3, No. 3, p 205-217, 1977. 4 fig, 2 tab, 24 ref.

Descriptors: *Cyanophyta, *Nitrogen fixation, *Molybdenum, *Temperature, Eutrophication, Metabolism, *Anabaena cylindrica, *Acetylene reduction, Metabolic process.

Joint effects of growth and incubation temperature and molybdenum concentration on the nitrogen fixation rate of the blue-green alga Anabaena cylindrica is determined using the acetylene reduction technique. Nitrogen fixation response to increased molybdenum concentration varied among three growth temperatures--15C, 23C and 30C. The rate change pattern was similar within a growth temperature but increased overall in magnitude with the three incubation temperatures (also 15C, 23C and 30C). Maximum rate of nitrogen fixation occurred at 30C regardless of previous growth temperature. The minimum molybdenum concentration necessary to yield substantial acetylene reduction varied with growth temperature. At all three growth temperatures, increases in molybdenum concentration above the minimum effective contraction produced increases in acetylene reduction. However a higher molybdenum concentration inhibition of nitrogen fixation occurred. the response of Anabaena cylindrica may also extend to other genera of nitrogen fixing blue-green algae, since the nitrogenase system is characteristic of known nitrogen fixing species. (Coyle-Wisconsin)
W78-02483

RATES OF REMINERALIZATION AND ASSIMILATION OF UREA BY FRACTIONATED PLANKTON POPULATIONS IN COASTAL WATERS,
Queen's Univ., Belfast (Northern Ireland). Marine Biology Station.
G. Savidge, and H. T. Hutley.
Journal of Experimental Marine Biology and Ecology, Vol. 28, No. 1, p 1-16, January 1977. 5 fig, 6 tab, 22 ref.

Descriptors: *Ureas, *Nitrogen, *Sea water, Phytoplankton, Eutrophication, *Size fractionated, *Assimilation, *Remineralization, Strangford Lough(Northern Ireland).

The study considers rates of remineralization and assimilation of (14)C-labelled urea in the dark by size-fractionated populations of plankton from selected sites in the vicinity of Strangford Lough, a large tidal inlet on the east coast of Northern Ireland. Urea appears to be a substantial component of the nitrogen system in the water of the Lough. Plankton populations from three contrasting sites were collected and fractionated by differential filtration into a larger fraction and smaller fraction.

Linear kinetics was generally found for total (14)C turnover by the larger and smaller fraction collectively. Lowest turnover times were always found at the station in open water outside the Lough. There was no relation between turnover time and in-situ urea concentrations. Maximum velocity of uptake of urea was greatest in May, least in August. Lowest values of urea were always encountered in the main water body of the Lough. Linear kinetics of (14)C urea turnover was not shown by the smaller fraction, a fraction which accounted for up to 40% of (14)C turnover. The proportion of (14)C utilized by the smaller fraction increased with increasing concentrations of added urea. (14)C was only assimilated by the larger fraction, the amount being 10% or less of the total (14)C turnover. (Coyle-Wisconsin)
W78-02484

TEMPORAL CHANGES IN PELAGIC BIOMASS OF PLEURONCODES PLANIPES STIMPSON (DECAPODA ANOMURA, GALATHEIDAE) OFF BAJA CALIFORNIA, MEXICO,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
M. Blackburn.
Crustaceana, Vol. 32, No. 2, p 178-184, 1977. 2 fig, 3 tab, 9 ref. NSF GX-33502.

Descriptors: *Temporal distribution, *Biomass, Benthic fauna, Pacific Ocean, *Mexico, Seasonal, *Pleuroncodes planipes, Pelagic nekton, Mean pelagic biomass, *Baja California.

Changes in the mean pelagic biomass of Pleuroncodes planipes taken by miconekton net off the west coast of Baja California, Mexico are analyzed. Preliminary studies reported Pleuroncodes planipes comprising 90% or more by weight of each of the samples. The remainders were fish and it was concluded that the pelagic nekton was almost entirely Pleuroncodes. The observed biomass of one group was always much less than the amount estimated from the growth rates, and in fact declined. Differences could be due to mortality, active or passive emigration, and descent to the bottom. Active emigration seems unlikely because Pleuroncodes are weak swimmers and area conditions appear favorable for them to remain in place. Passive emigration by current drift occurs but most of the known instances refer to younger and smaller planipes than in the observed group. If mortality or emigration or both reduced the biomass of the observed group, the biomass would become negligible. But the observed group remains very abundant in the area studied. It is concluded that much of the difference between the observed and expected biomass of the observed group is probably due to part of the biomass remaining on the bottom. (Coyle-Wisconsin)
W78-02485

PRELIMINARY BIOCHEMICAL OBSERVATIONS OF FISHES INHABITING AN ACIDIFIED LAKE IN ONTARIO, CANADA,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
W. L. Lockhart, and A. Lutz.
Water, Air, and Soil Pollution, Vol. 7, No. 3, p. 317-332, March, 1977. 1 fig, 4 tab, 72 ref.

Descriptors: *Fish reproduction, *Fish physiology, *Acid water, *Canada, Freshwater fish, Water types, Water pollution effects, Trace elements, Lake George(Ontario, Canada), Lake Manitoba(Ontaro, Canada), Roddy Lake(Ontario, Canada), Georgian Bay(Ontario, Canada).

Blood serum and other tissues of white suckers and other species of fish from Lake George (Canada) were examined in a preliminary effort to understand losses of fish from acid lakes. Values for hemoglobin indicated that an anticipated adaptive response to asphyxia was absent. Apparent sampling artifacts were noted in brown bullheads with respect to hematocrit, blood pH, sugar and inorganic phosphate analyses. No biochemical deficiencies were found in rib analyses, although it had been thought deformities observed in white suckers in the acid lake might be explained by demineralization of the skeleton. No indication of starvation was found and it appears that reduced growth was not caused by starvation. Female white suckers and other species undergoing reproductive failure did not achieve as great an excess of serum Ca values over males in the acid lake as they did in non-acid locations. It is suggested that calcium dynamics are altered in fish from the acid lake. High levels of manganese particularly in skin, were found in acid lake suckers. Calcium metabolism in fish seems to deserve increased attention in attempts to understand the pathology of acid pollution. (Coyle-Wisconsin)
W78-02486

GROWTH OF AN ESTUARINE PSEUDOMONAS SP. ON POLYCHLORINATED BIPHENYL,
Maryland Univ., College Park, Dept. of Microbiology.
G. S. Sayler, M. Shon, and R. R. Colwell.
Microbial Ecology, Vol. 3, No. 3, p. 241-255, 1977. 6 fig, 2 tab, 24 ref. NSF GD-31707, N.O.A.A. 04-5-15811, EPA R-803300-01-0.

Descriptors: *Polychlorinated biphenyl, *Microbial degradation, Sewage bacteria, Esturaine environment, Food chains, Chesapeake Bay, *Bacteria, *Estuarine bacteria, *Pseudomans strain 1008.

Preliminary results of a study of degradation of PCB by an estuarine bacterium indicate that a potential for microbial degradation of highly chlorinated commercial PCB mixtures exists in the estuarine environment. Studies of the degradation of PCB by isolates from freshwater and sewage-contaminated environments yielded a similar conclusion. And it is apparent also that there is a measurable bacteria action on polychlorinated biphenols, shown by low grade stimulation of growth, simulation of oxygen uptake during glucose metabolism, and accumulation of PCB in capsular slime when high PCB concentrations are added to the growth medium in the case of Pseudomans strain 1008. In addition the strain demonstrated an ability to degrade both a relatively pure PCB isomer and a commercial PCB preparation. The paper reports that since PCB's can evoke a response from microorganism under laboratory conditions, environmental influence of PCB at the microbial level requires further investigation. Sixteen cultures representing five bacterial genera were isolated during the study, which utilized Chesapeake Bay water. (Coyle-Wisconsin)
W78-02487

NUTRIENT-ALGAL RELATIONSHIPS IN LAKE LILLINONAH, DANBURY, CONNECTICUT, JUNE-SEPTEMBER, 1975.
National Enforcement Investigations Center, Denver, CO
Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 611, Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA-330/2-75/009, November, 1975. 37 p, 2 fig, 9 tab, 6 ref, 3 append.

Descriptors: *Phosphorus, *Nutrient removal, *Eutrophication, *Algal control, Nutrients, Cyanophyta, Anabaena, Aquatic weed control, Water pollution control, Waste water disposal, *Connecticut, Effluents, Impoundments, *Lake Lillinonah(CT), Aphanizomenon.

Lake Lillinonah, a narrow (1-1.5 km), 16 km-long impoundment of the Housatonic River in western Connecticut, receives effluent from the Danbury Wastewater Treatment Plant, which contributes over 30% of the lake's phosphorus load. Phosphorus has been found to be the growth-limiting nutrient for the summer algal blooms in the lake of the filamentous blue-green algae Anabaena and Aphanizomenon. This study concludes via field and laboratory tests that a reduction of 96% of the plant's phosphorus loading to the lake would reduce algal growth by at least 29% (each 1 microgram/l reduction in phosphorus would decrease algae by 0.02 mg/l dry weight,) and result in a phosphorus contribution to the lake of 0.01-0.02 mg/l. For minimum algal problems, the level of inorganic nitrogen should not exceed 0.30 mg/l, and orthophosphorus should not exceed 0.01 mg/l. Simulated lake water mixed with treatment plant effluent and inoculated with algal cells resulted in an algal growth increase of an average of 482% on a maximum dry-weight basis over lake water without the effluent. Effluent treated with calcium hydroxide precipated an average of 96% of the phosphorus, and effluent so treated stimulated 90% less algal growth. It is recommended that a state permit requiring phosphorus removal by the treatment plant be implemented. (Lynch-Wisconsin)
W78-02488

A CYTOCHEMICAL AND BIOCHEMICAL INDEX OF STRESS IN MYTILUS EDULIS L.,
Institute for Marine Environmental Research, Plymouth (England).
B. L. Bayne, D. R. Livingstone, M. N. Moore, and J. Widdows.
Marine Pollution Bulletin, Vol. 7, No. 12, p. 221-224, December 1976. 2 fig, 2 tab, 20 ref.

Descriptors: *Water pollution effects, *Mussels, *Bioindicators, *Enzymes, *Cytological studies, Indicators, Analytical techniques, Incubation, Estuarine environments, Laboratory tests, *Biological stress, Lysosomal enzymes, Lysosmes.

Two indices of stress, one measuring lysosomal stability and the latency of lysosomal enzymes, and the other measuring the ratio of taurine and glycine concentrations, were related to the scope for growth of the mussel Mytilus edulis. Measurements of lysosomal stability in the digestive cells of Mytilus over a period of eight months indicated consistent values for labilization period (length of incubation) ranging from 16-20 minutes. Starvation at 10 degrees C did not induce a significant decrease in latency in spite of the negative scope for growth. In other experimental treatments (18C, starved cells; 18C, fed cells; 25 degrees/o salinity, fed cells; 15 degrees/o salinity, fed cells) there was a significant reduction in the labilization. In all treatments there was a significant correlation between scope for growth and latency. The taurine concentration in the tissues did not change in response to temperature or ration stress and was little affected by the length of time the animals spend under laboratory conditions. The concentration of glycine declined in response to temperature increase but not in response to lack of food. A positive correlation was found between the taurine:glycine ration and the product of the temperature increment and time. While the taurine:glycine ration had a marked effect of the scope for growth it had little effect on the concentration of glycine. (Harris-Wisconsin)
W78-02489

LEAD IN PORT PHILLIP BAY MUSSELS,
La Trobe Univ., Bundoora (Australia). Dept. of Inorganic and Analytical Chemistry.
For primary bibliographic entry see Field 5A.
W78-02490

BIOACCUMULATION FACTORS OF CHLORINATED HYDROCARBONS BETWEEN MUSSELS AND SEAWATER,
California Univ., Bodega Bay. Bodega Marine Lab.
For primary bibliographic entry see Field 5A.
W78-02491

RELEASE OF DISSOLVED ORGANIC MATTER BY PHOTOSYNTHESIZING ALGAE IN LAKE KINNERET, ISRAEL,
Kinneret Limnological Lab., Tiberias (Israel).
T. Berman.
Freshwater Biology, Vol. 6, No. 1, p 13-18, 1976. 2 fig, 3 tab, 22 ref.

Descriptors: *Dissolved organic matter, *Photosynthesis, *Algae, Carbon, Dinoflagellates, Bacteria, Phytoplankton, Eutrophication, Trophic level, Lakes, Chlorophyta, *Lake Kinnert(Israel), *DOM release, Particulates, Chlorobium phaeobacteriodes, Peridinium cinctum.

The hypothesis that dissolved organic matter (DOM) released by algae is lower in eutrophic waters than in oligotrophic waters is confirmed by analysis of water samples taken at various depths in pelagic waters of Lake Kinneret, Israel from Aug. 1972 to Dec. 1973. The dinoflagellate Peridinium cinctum dominated in February and May during the annual bloom. A dense layer of photosynthetic green sulfur bacteria (Chlorobium phaeobacteroides) develops during summer after the bloom. Algal composition during fall and early winter is heterogeneous, with chlorophyta in the majority. Photosynthetic rates (particulate 14C assimilation) in the phototrophic zone varied from 560-8,052 mg/sq m/day (12 December and 25 April 1973), and from 102-2,589 mg/cu m/day on the same dates at depth of maximum photosynthesis. Released DOM ranged from 6.8-210.8 mg C/sq m/day (10 January and 18 July 1973) in the trophogenic zone and at optimum depths from 0.8-44.8 mg C/cu m/day on those dates. DOM released was directly related to particulate inorganic carbon assimilation. Despite the correlation between released DOM and the rate of photosynthetic fixation of carbon into particulate matter, there were considerable variations in the percentage of extracellular release (PER) of DOM in respect to total C assimilation by phytoplankton. PER was low during the Peridinium bloom, and high when algal standing crops were low. PER was inversely related to chlorophyll a concentration. (Lynch-Wisconsin)
W78-02492

SPECIFIC ASSOCIATION OF THE BLUEGREEN ALGAE ANABAENA AND APHANIZOMENON WITH BACTERIA IN FRESHWATER BLOOMS,
Department of Scientific and Industrial Research, Taupo (New Zealand).
H. W. Paerl.
Journal of Phycology, Vol. 12, No. 4, p 431-435, 1977. 2 fig, 11 ref. NSF-RANN GI-22.

Descriptors: *Algae, *Bacteria, *Symbiosis, Anabaena, Nitrogen fixation, Photosynthesis, California, Lakes, Cyanophyta, *Eutrophication, *Anabaena circinalis, *Aphanizomenon flos-aquae, Algal-bacterial associations, Heterocysts, Lake Rotongaio(New Zealand), Lake Rotaira(New Zealand), Clear Lake(CA).

Mechanism underlying association of heterocysts of two N2-fixing bluegreen algae, Anabaeno circinalis and Aphanizomenon flos-aqae, with attached bacteria during algal blooms, were investigated with microautoradiography and scanning electron microscopy on natural communities in Clear Lake, CA, and Lakes Rotongaio and Rotaira, New Zealand. Bacterial attachment to a wide range of bluegreen algae has been reported, but ecological significance has been neglected. It is suggested that attached bacteria assimilate substances released by the heterocysts: whether the algae benefit from the association is unknown. Conditions present during peak bloom are, however, reminiscent of symbiotic conditions noted with lichens. It has been pointed out that low 02 tension is essential for N2 fixation, while high 02 tension tends to be inhibitory. In Cyanophyta blooms photosynthetically generated concentrations of 02 build up in scums and surface waters. Bacterial respiration of organic substrates near the N2-fixing heterocyst may be effective enough to permit high rates of photosynthesis and N2 fixation during blooms. The study showed that bacteria are attached at the polar region of the heterocysts. Glucose, glycine, and alanine were assimilated by the small, rod-shaped bacteria. (Lynch-Wisconsin)
W78-02493

METABOLIC RELATIONSHIPS BETWEEN GREEN HYDRA AND ITS SYMBIOTIC ALGAE,
California Univ., Irvine. Dept. of Developmental and Cell Biology.
R. L. Pardy, and B. N. White.
Biological Bulletin, Vol. 153, No. 1, p. 228-236, August 1977. 2 tab, 23 ref. ASPHS RR07008.

Descriptors: *Metabolism, Carbohydrates, Chlorophyta, Food chains, *Green hydra, *Respiratory quotient, *Symbiotic algae, *Caloric demand.

Metabolic requirements of green hydra under various conditions are estimated and the major product of the animals' metabolism is deduced. Caloric demands of the association are compared with calories potentially available from nutrition provided by exogenous food and available from the symbiotic algae. Hydra that maintain algal symbients showed three modes of metabolism depending on the nutritional state of the host and the photoperiodic conditions under which the animals were maintained. Animals either fed or fasted but kept in the dark exhibited a respiratory quotient (RQ) of 0.725 indicating fat metabolism. Fasting green hydra maintained in the light showed a pronounced metabolism typified by an RQ of 0.970. Aposymbiotic hydra fed or fasted exhibited an RQ of 0.725 indicating a high degree of fat metabolism. Symbiotic hydra fed and maintained in light demonstrated a respiration rate 2.5 times greater than animals maintained under any other condition of fasting or photoperiod. Calculations based on respiratory measurements and indirect calorimetry suggest that hydra consume approximately 0.0320 calories per day and that symbiotic algae may supply up to 69% of the host caloric requirements. (Coyle-Wisconsin)
W78-02494

THE RELATIONSHIP BETWEEN PHOTOSYNTHESIS AND LIGHT FOR NATURAL ASSEMBLAGES OF COASTAL MARINE PHYTOPLANKTON,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
T. Platt, and A. D. Jassby.
Journal of Phycology, Vol. 12, No. 4, p. 421-430, 1976. 4 fig, 6 tab, 35 ref.

Descriptors: *Phytoplankton, *Photosynthesis, *Light intensity, Depth, Temperature, Marine microorganisms, Canada, Light, Respiration, Equation, Seasonal, Chlorophyll, Primary productivity, *Light saturation curve, Nova Scotia(Canada), St. Margaret's Bay(Canada).

Light-saturation measurements were made using populations of phytoplankton taken from three coastal locations off Nova Scotia during a 20-month period. Two depths were sampled on each sampling day. Uptake of 14C was measured at various levels of irradiance in specially-constructed water-cooled incubators using artificial illumination. Chlorophyll-a was measured in quadruplicate. The purpose of the research was to measure seasonal and photic-zone depth variations of three parameters of the light saturation curve, which relates photosynthesis per unit of chlorophyll biomass (P superscript B) to the irradiance. The three tested parameters were the initial slope of the light saturation curve, the specific production rate at optimal light intensity (the assimilation number), and the intercept at zero irradiance. It was found that initial slope and the assimilation number varied five-fold throughout the year, both decreased with depth, and both correlated positively with one another. Initial slope correlated positively with mean solar radiation, but not with temperature; the assimilation number correlated strongly with temperature but not with solar radiation. The assimilation number could be estimated from initial slope and temperature. Cell size and nutrient status may also be important factors. (Lynch-Wisconsin)
W78-02495

THE IMPORTANCE OF ALLOCHTHONOUS PARTICULATE CARBON PATHWAYS IN A SUBALPINE LAKE,
Washington Univ., Seattle. Fisheries Research Inst.
R. C. Wissmar, J. E. Richey, and D. E. Psyridakis.
Journal of Fisheries Research Board of Canada, Vol 34, No 4, p 1410-1418, September 1977. 4 fig, 3 tab, 65 ref. NSF GB-20963 and BMS-74-20744.

Descriptors: *Washington, *Carbon cycle, *Food chains, *Ecosystems, Carbon, Oligotrophy, Insects, Sedimentation, Lakes, *Findley Lake(WA), Insect production, Zooplankton production.

The paper examines some primary and secondary carbon pathways in Findley Lake, Washington, an oligotrophic subalpine lake near Seattle which has not been subject to any disturbance or management by man. The effort is to determine if material from outside the immediate ecosystem contributes significant amounts of organic matter for use by consumers. Seasonal and annual values are given for inputs of such allochthonous matter, phytoplankton production, and consequent carbon flows to important consumers, with results discussed in the form of a pedagic carbon budget and a pelagic benthic carbon flow diagram. Results suggest that allochthonous carbon provides a food base for insect production and autochthonous production of carbon appears to maintain zooplankton production. Most of the autochthonous carbon losses through grazing and respiration were retained in the water column. A pelagic carbon budget did not balance by a number well within the propagated variations of 26% and 21% respectively for input and outputs. The study illustrates the probable dependence of many lakes in coniferous forests upon allochthonous inputs and their sensitivity to land-based disturbances. (Coyle-Wisconsin)
W78-02496

CHRONOLOGY OF ORGANOCHLORINE COMPOUNDS IN LAKE MICHIGAN FISH, 1929-66,
Wisconsin Univ.-Madison. Dept. of Wildlife Ecology.
For primary bibliographic entry see Field 5A.
W78-02497

EFFECTS PRODUCED BY EXTRACTS OF MACROSCOPIC MARINE ALGAE ON BACTERIAL GROWTH, (IN SPANISH),
Universidad Central de Venezuela, Caracas. School of Biology.
G. Nunez, and L. M. Serpa Sanabria.
Acta Biol Venez 9(1), p 121-134, 1975.

Descriptors: *Marine algae, *Bacterial growth, Bacteria, Coasts, Pollutant identification, Bacteria, E. coli, *Venezuela.

In vitro experiments carried out with organic extracts of macroscopic marine algae collected from the Venezuelan central coast showed that some species produce substances with antibiotic character against gram-positive bacteria and Escherichia coli.--Copyright 1978, Biological Abstracts, Inc.
W78-02498

CONTROLLING AQUATIC WEEDS,
New York Sea Grant Advisory Service, Albany.
For primary bibliographic entry see Field 5G.
W78-02500

WATERFOWL AS INDICATOR FOR THE ECOLOGICAL QUALITY OF LAKES, (IN GERMAN),
For primary bibliographic entry see Field 5A.
W78-02501

KEPONE BIOCONCENTRATION, ACCUMULATION, LOSS AND TRANSFER THROUGH ESTUARINE FOOD CHAINS,
Environmental Research Lab., Gulf Breeze, FL.
L. H. Bahner, A. J. Wilson, Jr, J. M. Sheppard, J. M. Patrick, Jr, and L. R. Goodman.
Chesapeake Science, Vol. 18, No. 3, p. 299-308, September 1977. 9 fig, 5 tab, 15 ref.

Descriptors: *Trophic level, Estuarine environments, *Chesapeake Bay, *Oysters, *Shrimp, *Water pollution effects, *Food chains, Algae, Fish, *Virginia, *James River(VA), *Kepone, Mysids.

Accumulation, transfer and loss of Kepone in estuarine organisms was studied in laboratory bioassays in light of contamination of the James River. Biota of the James River estuary and Chesapeake Bay contain Kepone, apparently due to transport of the chemical downstream from the freshwater portion of the river. Kepone was bioconcentrated by oysters, grass shrimp, sheepshead minnows and sppt. Bioconcentration factors ranged from ten to 340 in static exposures and 900 to 13,500 in flow-through bioassays, and were dependent on species and exposure duration. Depuration of Kepone from oysters in Kepone free water was rapid--35 per cent in 24 hours. Depuration of Kepone was slow in crustaceans and fish, with tissue concentrations decreasing 30 per cent to 50 per cent in 24 to 28 days. Spot obtained Kepone when fed live mysids that had grazed on Kepone laden brine shrimp, approaching the concentration of their food. At lower concentrations tested, Kepone concentrations below detection limits in prey accumulated in the predator to detectable concentrations within 30 days. Initial bioconcentration of Kepone from water by plankton was the dominant source of Kepone to each member of this food chain. But significant quantities of Kepone transferred from prey to predatory fish. (Coyle-Wisconsin)
W78-02502

UTILIZATION OF EXOGENOUS PURINE AND PYRIMIDINE COMPOUNDS BY BACTERIA ISOLATED FROM WATER BASINS, (IN RUSSIAN),
Latvian State Univ., Riga.
For primary bibliographic entry see Field 5A.
W78-02503

ENVIRONMENTAL REGULATION OF PHYTOPLANKTON PRODUCTIVITY IN THE LOWER HUDSON ESTUARY,
City Univ. of New York. Dept. of Biology.
T. C. Malone.
Estuaries and Coastal Marine Science, Vol. 5, No. 2, p. 157-171, March 1977. 11 fig, 1 tab, 25 ref. NOAA 03-4-0430310 and 04-5-022-22.

Descriptors: *New York, *Eutrophication, *Phytoplankton, Estuarine environment, Estuaries, *Primary productivity, Chlorophyll, Euphotic zone, Bays, *Hudson Bay, *Net plankton, Advective transport.

Research was undertaken to determine mechanisms by which phytoplankton biomass in the lower Hudson estuary around New York City remains low while nutrient input rates are high and predictable. Except during the summer when phytoplankton growth rates were high, increases in phytoplankton biomass were related to the advection of phytoplankton into the lower Hudson estuary from Raritan Bay or the apex of the New York Bight. Although major nutrient concentrations were consistently high, net plankton growth rates were apparently less than flushing rates and, therefore, too low to generate blooms in the lower estuary. It is considered unlikely that the balance between growth rate and advective transports determines the distribution of phytoplankton biomass throughout the year. Grazing could also be an important factor during the summer and fall. In addition to discussion of estuarine circulation and zooplankton grazing on phytoplankton biomass, there is discussion of monthly variations in phytoplankton productivity and the environmental regulation of chlorophyll a specific primary productivity in the upper bay. (Coyle-Wisconsin)
W78-02505

APPLICATION OF STOCHASTIC METHODS IN EUTROPHICATION,
General Electric Co., Santa Barbara CA. Center for Advanced Studies.
L. G. Everett, and G. C. Slawson, Jr.
Journal of Environmental Systems, Vol. 6, No. 4, p. 343-353, 1976-77. 1 fig, 14 ref.

Descriptors: *Monte Carlo method, *Poisson ratio, *Eutrophication, *Stochastic processes, *Phytoplankton, Zooplankton, Mathematical models, Model studies, Nutrients.

A stochastic model of a phytoplankton-zooplankton population is described where x and y represent the respective sizes of the two populations. The state of the system at any time can be represented by the ordered pair, x, y. The system can change state as a result of either births or deaths of either species. Migrations are not considered, although it is conceded that they pose serious additional difficulties. It is assumed that births and deaths are independent events that individually satisfy the four assumptions of the Poisson process. Water temperature, solar radiation, and nutrients from external sources are inputs to the model. It is notes that model evaluation is extremely important and extremely difficult and the model outlined in the paper has not been applied to a real world situation. Evaluation is thus restricted to the model described and other models that have been evaluated. Specific comparisons are made with the differential equation model developed by DiToro and the Monte Carlo simulation. It is reported that the model described has indicated a deficiency in data generally available and to calibrate, data should be taken more frequently than every two or three weeks. (Coyle-Wisconsin)
W78-02506

POLLUTION HISTORY OF ESTUARINE SEDIMENTS,
Scripps Institution of Oceanography, La Jolla, CA.
For primary bibliographic entry see Field 5B.
W78-02509

NUTRIENT CYCLING AND PRODUCTIVITY OF DYSTROPHIC LAKE-BOG SYSTEMS (PART A), APPENDIX C: MAT-WATER EXCHANGE IN A STRATIFIED BOG LAKE,
Michigan Univ., Ann Arbor. Dept. of Zoology.
F. F. Hooper, and J. P. Koenings.
Available from the National Technical Information Service, Springfield, VA 22161 as COO17716, Price codes: A04 in paper copy, A01 in microfiche. In: Publication No 016440-7-T, December 1975. 14 p, 2 fig, 4 tab, 7 ref. AT(11-1)-1771.

Descriptors: *Stratification, *Bogs, *Thermal stratification, *Lakes, Meromixis, Acidic water, Michigan, Phosphorus, Iron, Nutrients, Interstices, *North Gate Lake(MI), *Sphagnum, *Mats, Mat-water interfaces, Dichothermy, Monimolimnion.

An investigation was made in a stratified bog lake of the relationship of mat-water exchanges to the lake's circulation, thermal structure, and chemical cycles. The bog community consisted of an open lake (North Gate Lake, Gogebic County, MI) of highly stained acid water; a marginal floating mat of Spagnum and bog shrubs; and a marginal forest of black spruce and tamarack. North Gate Lake has a surface area of about 0.4 ha. A stratum between 7 and 8 m does not circulate during the vernal overturn, leaving a small monimolimnion and temperature inversion. 1971 mat-labelling experiments using P-32 suggested the possibility of density-flow currents moving through the mat-water interface zone into the deeper water; thermal profile data were collected which demonstrated that isotherms of the mat interstitial water dip sharply toward the hypolimnion. Phosphorus and iron transport from the mat zone to the monimolimnion early in the spring is thought to be the mechanism for maintaining dichothermy in the lake. Heat input from the bottom of the basin after the spring overturn and resulting increase in monimolimnion thickness coincided with increasing phosphorus concentration. The study showed that the mat-water interface of stratified bog lakes provides a site for dispersion processes not found in non-bog stratified lakes. (Lynch-Wisconsin)
W78-02510

A BIOLOGICAL AND CHEMICAL COMPARISON OF VARIOUS AREAS OF A RESERVOIR,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
A. C. Hendricks, and J. K. G. Silvey.
Water Research, Vol 11, No 5, p 429-438, 1977. 3 fig, 8 tab, 18 ref.

Descriptors: *Limnology, *Eutrophication, *Microbiology, *Nutrients, *Texas, Reservoirs, Water pollution effects, *Garza-Little Elm reservoir(TX).

A limnological survey was made of the Garza-Little Elm reservoir on the North Fork of the Trinity River, about 22 miles northwest of Dallas, Texas. Purpose were to obtain an indication of the nutrients present, the standing crop of primary producers, and the microbial activity. Water samples from diverse areas of the reservoir were analyzed for gross and net productivity, respiration, BOD, chlorophyll-a, phosphates and nitrates, autotrophic and heterotrophic carbon-14 uptake, pH and bicarbonate contents. The areas were physically different--covers, open water and near-shore water, with testing designed to determined if biochemical differences also exist among the areas. Data indicated that a cove with a marina located on it was not significantly different from one that did not have a marine but was similar in other respects. An open water area in which many trees had been left standing was more eutrophic than other areas nearby. Another open water area with sediments rich in nutrients was less eutrophic than shallower areas near it. (Coyle-Wisconsin)
W78-02514

RESEARCH PROGRAM ON HAZARD PRIORITY RANKING OF MANUFACTURED CHEMICALS: PHASE II--FINAL REPORT (CHEMICALS 41-60),
Stanford Research Inst., Menlo Park, CA.
For primary bibliographic entry see Field 5A.
W78-02614

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 8, PESTICIDES INDUSTRY,
Radian Corp., Austin, TX.
For primary bibliographic entry see Field 5B.
W78-02615

MONITORING ENVIRONMENTAL IMPACTS OF THE COAL AND OIL SHALE INDUSTRIES RESEARCH AND DEVELOPMENT NEEDS,
Radian Corp., Austin, TX.
For primary bibliographic entry see Field 5A.
W78-02619

ENVIRONMENTAL, HEALTH, AND CONTROL ASPECTS OF COAL CONVERSION: AN INFORMATION OVERVIEW: VOLUMES 1 AND 2.
Oak Ridge National Lab., Oak Ridge, TN.
Available from the National Technical Information Service, Springfield, VA 22161 as ORNL-EIS-94, Price codes: A23 in paper copy, A01 in microfiche. Report No. ORNL/EIS94, UC-11, -41, -48, -90i, 2 volumes, April 1977. 1,440 p, 268 fig, 467 tab, 1,722 ref, 4 append. Braunstein, H. M., Copenhaver, E. D., and Pfuderer, H. A., Eds. W-7405-eng-26.

Descriptors: *Coals, *Environmental effects, *Pollutants, Water pollution, Public health, Physical properties, Chemical properties, Technology, Effluents, Biology, Microbiology, Chemicals, *Coal conversion.

Environmental and health information about possible pollutants from coal conversion processes is presented. The information overview assembles and summarizes relevant technical information gathered from several disciplines into a single data source without assessing the data or sythesizing new data from its collection. Topics discussed include: origin, classification, and physical and chemical properties of coal; coal conversion processes; quantities and control technologies from process effluents; analysis of coal and coal products; environment interactions; microbial interactions; plant interactions; bioenvironmental effects on animals; and metabolism and biological effects on humans. Four appendices present related information on unit conversion, glossary of terms, glossary of polycyclic aromatic hydrocarbons, and a chemical index. (Wares-IPA)
W78-02622

PROCEEDINGS OF THE NINTH DREDGING SEMINAR.
Texas A and M Univ., College Station. Center for Dredging Studies.
Sea Grant Report No. TAMU-SG-77-115, October 1977. 267 p. Also as CDS Report No. 206. J. B. Herbich (Ed.).

Descriptors: *Dredging, *Benthos, *Mining, *Waste disposal, Pollution, *Spoil banks, Heavy metals, Phosphates, Ecosystems, *Dredging, Water pollution effects, Environmental effects, Corbicula manilensis.

The following papers were presented at the Ninth Dredging Seminar sponsored by the Center for Dredging Studies at Texas A&M University, College Station, Texas: Stabilization of coastal subaerial dredged material sites in North Carolina; Availability of sediment-adsorbed heavy metals to benthic deposit-feeding organisms; Feasibility of developing biological habitats on dredged material; Mining of phosphates by dredge; Techniques for reducing turbidity with present dredging procedures and operations; The future of the dredging market; Selected environmental aspects of dredging in San Diego Bay, California; Corbicula manilensis Phillipi in the Arkansas River: Should the Corps of Engineers be concerned; Cost-effectiveness analysis of solids-liquid separation alternatives in dredged material disposal operations; Research to dewater dredged material; Primary consolidation and compressibility of dredgings; and Stabilization of polluted dredgings by electro-osmosis. (NOAA)
W78-02646

A RATIONALE FOR EVALUATING THERMALLY INDUCED BIOLOGICAL EFFECTS DUE TO ONCE-THROUGH COOLING SYSTEMS,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
H. H. Carter, J. R. Schubel, R. E. Wilson, and P. M. J. Woodhead.
Special Report No. 7, Reference 77-3, September 1977. 75 p, 46 fig, 8 tab, 59 ref.

Descriptors: *Thermal pollution, *Cooling water, *Water pollution effects, *Powerplants, *Baseline studies, Ecology, Ecosystems, Model studies, *Environmental impact, *Biological effects, Ecological assessment, Open cycle, Cooling systems, Fish populations.

A simple thermal response model was developed that combines in graphical form: (1) the distribution of thermal doses computed from the physical models for an assumed distribution of organisms in the receiving waters with (2) the distribution of thermal doses calculated from laboratory-determined thermal resistance curves which have demonstrated to produce mortality at a particular level, usually 50%, for Representative Important Species. From the relative positions of these two curves, predictions can be made of the mortality rate expected from thermal stresses at a particular site. The thermal response model can be used with data from existing and proposed power plants to estimate what fraction of plankton in waters contiguous to the plant will be exposed to thermal doses greater than that for mortality at any stated level, usually 50%. The model can also be used to aid in the design of once-through cooling systems to keep the mortality rate caused by thermal stresses below any designated threshold. The inputs to the model are the frequency distribution of time-excess temperature histories experienced by the plankton of particular concern, thermal resistance curves for those organisms, and the spatial and temporal variations of the natural temperature of the receiving waters. (NOAA)
W78-02647

OHIO EPA WATER QUALITY STUDIES IN THE SANDUSKY RIVER BASIN,
Ohio State Environmental Protection Agency, Bowling Green. Northwest District Office.
For primary bibliographic entry see Field 5G.
W78-02649

AQUATIC VASCULAR PLANTS OF THE SANDUSKY RIVER BASIN,
Ohio State Univ., Columbus. Dept. of Botany.
For primary bibliographic entry see Field 5G.
W78-02650

SHORELINE AND BATHYMETRIC CHANGES IN AND AROUND UPPER SANDUSKY BAY SINCE 1905,
Ohio Dept. of Natural Resources, Sandusky. Div. of Geological Survey.
C. H. Carter, D. J. Benson, and D. E. Guy.
In: Proceedings of Sandusky River Basin Symposium, Held at Tiffin, Ohio on May 2-3, 1975. p 335-357. 4 fig, 6 tab, 3 ref.

Descriptors: *Bathymetry, *Lake Erie, *River basins, *Shores, *Sedimentation, Beach erosion, Sedimentation rates, Depth, Bays, Erosion, Eutrophication.
Identifiers: *Sandusky Bay(OH), *Sandusky River Basin(OH).

Much of the upper shore of Upper Sandusky Bay is receding and filling simultaneously with sediment derived from the upper bay shore and from the Sandusky River. Upper Sandusky Bay receives about 209,000 tons/yr of sediment from erosion of the upper bay shore and 284,000 tons/yr from the Sandusky River. Most of the sediment is deposited in the upper bay, with an annual deposition rate of 5.5 mm. At this rate the upper bay has a life expectancy of 300 to 400 years. The loss of land in the upland area and at the shore, and sedimentation in the bay, are expected to be accompanied by increasing turbidity, a change in bottom texture, and an increase in eutrophication. Current measurements of the bay depth and relief were made in 1973-74. Upper Sandusky Bay is shallow (mean depth 5-6 ft), and is bordered by low-relief, easily erodable, clay-rich banks. The nearshore slope is less than one degree; offshore the bottom is nearly horizontal. Shore relief is low (5-6 ft); wave action is largely responsible for shore erosion. Both north and south shores have a modal recession rate of 1-3 ft/yr. However, the range is much greater on the south shore (<1 ft/yr to 13-15 ft/yr)k than the north shore (<1 ft/yr to 7-9 ft/yr) 62% of the south shore receded at the 3-5 ft/yr rate compared with 9% of the north shore. These differences appear primarily due to shoreline orientation. (See also W78-01518) (Lynch-Wisconsin)
W78-02651

ENVIRONMENTAL CONTAMINATION FROM TRACE ELEMENTS IN COAL PREPARATION WASTES. A LITERATURE REVIEW AND ASSESSMENT,
Los Alamos Scientific Lab., NM.
For primary bibliographic entry see Field 5B.
W78-02655

MERCURY CONTENT OF MUSSELS FROM ST. LAWRENCE ESTUARY AND NORTHWESTERN GULF OF ST. LAWRENCE, CANADA,
For primary bibliographic entry see Field 5A.
W78-02671

RESTORATION OF WATER QUALITY IN LAKE WESTON, ORLANDO, FLORIDA,
Orange County Pollution Control Dept., Orlando, FL.
For primary bibliographic entry see Field 5G.
W78-02678

RESIDUAL 2,4-D LEVELS IN THE ST. JOHNS RIVER, FLORIDA,
Army Engineer District, Jacksonville, FL.
For primary bibliographic entry see Field 5A.
W78-02679

GENETIC ASPECTS OF LARVAL GROWTH UNDER REDUCED SALINITY IN MYTILUS EDULIS,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Biology.
D. J. Innes, and L. E. Haley.
Biology Bulletin, Vol 153, p 312-321, October 1977. 2 fig, 2 tab, 30 ref.

Descriptors: *Mussels, *Growth rates, *Genetics, *Salinity, Analytical techniques, Water properties, Laboratory tests, Larval, Mollusks, Invertebrates, Water quality, Animal behavior.

There was no significant difference in mean length between Mytilus edulis larvae raised at 30o/oo and those raised at 18o/oo after 18 days of growth. Salinities below this significantly decreased growth. Families of larvae of known parentage were raised at different salinities. The genetic analysis indicated substantial genetic variation in larval length measured 16 days after fertilization, as well as significant genetic interaction with salinity. This was interpreted as the presence of genes influencing larval growth which depend on salinity for their expression and may be related to the past selective influence of a fluctuating environment. These quantitative genetic techniques provided a useful approach to studying genetic variation in marine organisms and its interaction with the environment. (Klein)
W78-02685

EFFECT OF DISSOLVED OXYGEN CONCENTRATIONS AND SALINITY ON SWIMMING SPEED OF TWO SPECIES OF TUNA,
National Marine Fisheries Service, Honolulu, HI. Southwest Fisheries Center.
A. E. Dizon.
Fisheries Bulletin, Vol 75, No 3, p 149-153, 1977. 3 fig, 1 tab, 7 ref.

Descriptors: *Dissolved oxygen, *Fish behavior, *Fish physiology, *Salinity, Oxygen, Marine fish, Toxicity, Mode of action, Water quality, Temperature, Oxygen requirements, Respiration, Environmental effects, Resistance, *Swimming speed, *Skipjack tuna, *Yellowfin tuna, *Tuna.

Behavioral responses of skipjack tuna and yellowfin tuna to decreasing levels of salinity were unremarkable. No consistent swimming speed changes were observed when salinity was decreased from 34% to 29%. Yellowfin tuna were not apparently stressed by low dissolved oxygen levels. The relation between increased swimming speeds and decreased water oxygen content of other species was discussed. (Klein)
W78-02686

THE UPTAKE, DISTRIBUTION, AND DEPURATION OF 14C-BENZENE AND 14C-TOLUENE IN PACIFIC HERRING CLUPEA HARENGUS PALLASI,
National Marine Fisheries Service, Auke Bay, AK. Auke Bay Lab.
S. Korn, N. Hirsch, and J. W. Stuhsaker.
Fishery Bulletin, Vol 75, No 3, p 633-636, 1977. 1 tab, 8 ref.

Descriptors: *Organic compounds, *Metabolism, *Distribution, *Absorption, *Herrings, *Aromatic compounds, *Carbon radioisotopes, Retention, Path of pollutants, Analytical techniques, Distribution patterns, Fish physiology, Radiochemical analysis, Bioaccumulation, Tissue analysis, *Benzene, *Toluene, Depuration, Clupea harengus.

In all herring tissues toluene accumulated to higher levels than did benzene despite the faster loss of toluene compared with benzene. The gallbladder exhibited the highest accumulation of both toluene and benzene; the immature gonad accumulated the least. Within 24 h maximum residues were obtained in all tissues except the gallbladder and pyloric caeca. Toluene accumulated to the maximum level before benzene peaked in all tissues except the gallbladder and intestine. Residues were depurated rapidly with most tissues having detectable amounts after 3-4 days. The gallbladder, intestine and pyloric caeca retained residues through the duration of the study (7 days). (Klein)
W78-02687

RESPONSES OF PERCID FISHES AND THEIR HABITATS TO EUTROPHICATION,
Lake Erie Fisheries Research Station, Wheatley (Ontario).
J. H. Leach, M. G. Johnson, J. R. M. Kelso, J. Hartmann, and W. Numann.
Journal of the Fisheries Research Board of Canada, Vol 34, p 1964-1971, 1977. 2 fig, 3 tab, 43 ref.

Descriptors: *Eutrophication, *Fish behavior, *Fish, Habitats, Trophic level, Resistance, Physiochemical properties, Fish behavior, Freshwater fish, *Environmental effects, Benthos, Zooplankton, Phytoplankton, Water quality, Ecosystems, Food chains, Populations, Aquatic plants, Forage fish, Lakes, *Percid fish.

Percid fishes were found in lakes that covered a wide range of trophic conditions. The responses of percides and their habitats to progressive cultural eutrophication were investigated. Alterations in physiochemical characteristics of habitats precipitated changes in phytoplankton, macrophytes, zooplankton, and benthos that were ultimately deleterious. Enrichment initially lead to favorable responses in percides but eventually became unfavorable. The relative level at which the response became negative varied with the species according to tolerances to altered environment, adaptabilities to new habitat and forage base, and reproductive behavior. Other perturbations such as exploitation and habitat modification acted synergistically with cultural eutrophication in accelerating the sequence. (Klein)
W78-02688

EFFECTS OF SALINITY ON FASTED RAINBOW TROUT, SALMO GAIRDNERI,
Stirling Univ. (Scotland). Dept. of Biology.
M. G. MacLeod.
Marine Biology, Vol 43, 1977, p 103-107. 3 fig, 11 ref.

Descriptors: *Rainbow trout, *Salinity, *Bioassay, Laboratory tests, *Fish diets, *Fish farming, Aquiculture, Fish physiology, Fish hatcheries, Fish food, Estuaries, Starvation, Fasting, Weight loss, Muscle water, Tissue water.

Rainbow trout (Salmo gairdneri Richardson) which has been maintained for 120 days in salinities of fresh water, 7.5, 15.0 and 32.5 o/oo at 10C were fasted for up to 48 days under these same environmental conditions. Live weight loss between Days 7 and 48 of starvation could be described by a straight line, as could the decrease in condition factor. Trout maintained in 32.5 o/oo S showed a significantly greater weight loss than those in salinities of 15.0o/oo and below. Muscle water content increased slightly during fasting in fresh water, 7.5 and 15.0o/oo S. In 32.5o/oo S, however, muscle water fell significantly between Days 19 and 37. Liver water content also increased slightly during fasting, except in 32.5o/oo S, where water content again decreased betwee Days 19 and 37. The volume of the gall bladder contents increased during fasting. (Katz)
W78-02689

EFFECTS OF SALINITY ON FOOD INTAKE, ABSORPTION AND CONVERSION IN THE RAINBOW TROUT SALMO GAIRDNERI,
Stirling Univ. (Scotland). Dept. of Biology.
M. G. MacLeod.
Marine Biology, Vol 43, 1977, p 93-102. 3 tab, 7 fig, 38 ref.

Descriptors: *Rainbow trout, *Salinity, *Bioassay, Laboratory tests, *Fish diets, Fish farming, *Aquiculture, *Fish physiology, Fish food, Water temperature, Growth, *Nitrogen compounds, Proteins, Food intake, Growth rate, Absorption efficiency, Total nitrogen, Energy conversion.

In rainbow trout (Salmo gairdneri Richardson) which had been acclimatised to the experimental salinity and temperature, food intake was maximal in the intermediate salinities of 15.0 and 28.0 o/oo, less in fresh water and 7.5o/oo and minimal, by a statistically significant margin, in 32.5o/oo. When salinity was abruptly increased by 7.5 or 13.0o/oo, there were decreases in growth rate which were related to decreases in food intake. Recovery of food intake and growth rate to pre-increase levels was complete within 14 days. Absorption efficiency, in terms of total dry matter, total energy and total nitrogen, was negatively related to salinity. Total nitrogen was absorbed considerably more efficiently than either energy or dry matter. Conversion efficiency (K1 and K2) was estimated, also in terms of dry matter, energy and total nitrogen, in trout of the 0+ and 1+ year groups weighing from 50 to 150 g. There was tendency for conversion efficiency to decline with salinity, especially between 28.0 and 32.5o/oo. Dry matter and energy conversion were significantly lower than nitrogen conversion efficiency. (Katz)
W78-02690

SOME ASPECTS OF THE THERMAL TOLERANCE OF TRICHOMYA HIRSUTA (MOLLUSCA: BIVALVIA) OF EASTERN AUSTRALIA,
New South Wales Univ., Kensington (Australia). School of Zoology.
R. L. Wallis.
Marine Biology, Vol 43, 1977, p 217-223. 4 tab, 4 fig, 22 ref.

Descriptors: *Bioassay, *Thermal pollution, *Thermal stress, Thermal water, Water pollution effects, Molluscs, *Clams, *Australia, Animal physiology, Food, Temperature, Mussels, *Upper temperature tolerance range, Bivalve molluscs, Trichomya, Thermal resistance, Incipient lethal temperatures, Eurythermal incipient sublethal temperature.

The upper temperature tolerance range for Trichomya hirsuta L. is described for acclimation temperatures of 10 to 32C at 30 o/oo S. Changes in thermal resistance with time are described along with the incipient lethal temperatures. The eurythermicity for the species is 240.7C degrees-squared. The ultimate upper incipient lethal temperature is 35.1C. Definition of the incipient sublethal temperature is given, and is equal to 32C. Diet effects are shown not to be significant in short-term lethal experiments, but indicate that unfed mussels reduce their resistance after prolonged exposure to high temperatures. Size was also shown to have no effect on resistance and tolerance. A comparison of the tolerance triangle of T. hirsuta with those of the temperate species Mytilus edulis and Mya arenaria revealed that the 24-h LT50 minus 2.2C approximates the incipient lethal temperature. The eurythermicities of the temperate species are Mytilus edulis, 363C degrees-squared; and Mya arenaria, 415C degrees-squared. (Katz)
W78-02691

EFFECTS OF TEMPERATURE ON PHOTOSYNTHESIS AND RESPIRATION IN HERMATYPIC CORALS,
Hawaii Inst. of Marine Biology, Honolulu.
S. L. Coles, and P. L. Jokiel.
Marine Biology, Vol 43, 1977, p 209-216. 1 tab, 2 fig, 31 ref.

Descriptors: *Hawaii, Photosynthesis, Respiration, *Bioassay, *Thermal pollution, *Thermal stress, Thermal water, Water pollution effects, Animal physiology, Temperature, Invertebrates, *Coral, *Pacific Ocean, *Reefs, Laboratory tests, Respiration rates, *Reef corals, Pocillopora, Montipora, Porites, Fungia, *Coral metabolism, Tropical corals, Hawaiian corals, *Enewetak corals, Hermatypic corals, *Enewetak.

Photosynthesis and respiration rates of the reef corals Pocillopora damicornis, Montipora verrucosa, Porites compressa and Fungia scutaria were measured under controlled temperatures. Results indicate that coral metabolism is closely adapted to ambient temperature conditions. Tropical corals measured at Enewetak, Marshall Islands, showed greater primary production compared to maintenance requirements at elevated temperatures than did subtropical varieties of the same species in Hawaii. Photosynthesis:respiration (P:R) ratios were significantly and negatively related with temperature between 18 and 31C for all Hawaiian corals, whereas at Enewetak this ratio generally showed a curvilinear relationship for this temperature range. Extrapolations of P:R regressions on temperatures to a value of 2.0 (estimated as a minimum required for long-term functional autotrophy) coincide for Hawaiian specimens with published upper lethal temperatures. Extrapolation of P:R regressions for Enewetak specimens at temperatures above 25C suggests lethal temperatures for these corals to be 2 to 5C higher than for Hawaiian corals, in good agreement with recent experimental findings. Interspecific differences in P:R temperature regressions for Hawaiian corals

correlating with upper lethal temperature tolerances are described. (Katz)
W78-02692

EFFECTS OF MERCURY ON THE BEHAVIOUR AND OXYGEN CONSUMPTION OF MONODONTA ARTICULATA,
Royal Univ. of Malta, Valleta. Dept. of Biology.
L. J. Saliba, and M. G. Vella.
Marine Biology, Vol 43, 1977, p 277-282. 3 tab, 2 fig, 20 ref.

Descriptors: *Metals, *Mercury, Water pollution effects, *Animal behavior, Pathology, Animal physiology, Molluscs, *Snails, *Bioassays, Laboratory tests, Oxygen, Oxygen requirements, Sea water, Laboratory tests, Respiration, Oxygen consumption, Trochid snail, Mercuric sulphate.

The trochid snail Monodonta articulata Lamarck was exposed to mercuric sulphate at concentrations of 0.2, 0.5, 0.8 and 1 ppm Hg++. At 24 h, retraction into the shell was observed in 0.8 and 1 ppm Hg++; this retraction increased in these concentrations at 36 h. Retracted snails died if retained in the solutions, but generally recovered within 24 to 48 h if transferred to uncontaminated sea water. Immersion-emersion behaviour and interface activity were studied over 24 h by means of an aktograph; snails in normal sea water spent more time below than above the water surface, and exhibited frequent periods of activity. Exposure to mercuric sulphate at concentration of 0.25, 0.5, 0.8 and 1 ppm Hg++ progressively reduced both the length and frequency of activity periods. From 0.5 ppm Hg++ upwards, emersion periods increased, and immersion periods decreased. Oxygen consumption of snails was measured in sea water and in mercuric sulphate at concentrations of 0.2, 0.5, 0.8 and 1 ppm Hg++. Oxygen consumption decreased significantly with each progressive rise in mercury concentration. It is considered that mercury affects M. articulata by interfering with respiration, initially reducing interface activity, then forcing the snail for longer and longer periods out of the water. (Katz)
W78-02693

EFFECTS OF TEMPERATURE ON THE MORTALITY AND GROWTH OF HAWAIIAN REEF CORALS,
Hawaii Inst. of Marine Biology, Honolulu.
P. L. Jokiel, and S. L. Coles.
Marine Biology, 43(1977), p 201-208. 4 tab, 3 fig, 28 ref.

Descriptors: *Coral, *Temperature, *Bioassay, Mortality, *Hawaii, *Reefs, Water pollution effects, Thermal pollution, *Thermal stress, Thermal water, Animal physiology, Invertebrates, Pacific Ocean, Laboratory tests, Sea-water, Animal physiology, *Hawaiian reef corals, Pocillopora, Montipora, Fungia, Continuous flow bioassay, Clacification.

Three common species of Hawaiian reef corals, Pocillopora damicornis, Montipora verrucosa, and Fungia scutaria, were grown in a temperature-regulated, continuous-flow sea water system. The skeletal growth optimum occurred near 26C, coinciding with the natural summer ambient temperature in Hawaii, and was lowest at 21 to 22C, representing Hawaiian winter ambient. Levels of approximately 30C eventually caused loss of photosynthetic pigment, increased mortality, and reduced calcification. Corals lived only 1 to 2 weeks at 18C. The corals showed greater initial resistance at the lower lethal limit, but ultimately low temperature was more deleterious than high temperature. Results suggest that a decrease in the natural water temperature of Hawaiian reefs would be more harmful to corals than a temperature increase of the same magnitude. (Katz)
W78-02694

SOME LABORATORY CULTURED CRUSTACEANS FOR MARINE POLLUTION STUDIES,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
For primary bibliographic entry see Field 5A.
W78-02695

UPTAKE OF CADMIUM AND LEAD BY A ROOTED AQUATIC MACROPHYTE (ELODEA CANADENSIS),
Purdue Univ., Lafayette, IN. Dept. of Bionucleonics.
R. A. Mayes, A. W. McIntosh, and V. L. Anderson.
Ecology, Vol. 58, p 1176-1180, 1977. 3 tab, 2 fig, 15 ref.

Descriptors: *Path of pollutants, *Rooted aquatic plants, *Cadmium, *Lead, *Trace elements, *Absorption, *Aquatic plants, *Sediments, *Water pollution sources, Heavy metals, Metals, Submerged plants, On-site investigations, Elodea, Bioaccumulation, Mineral cycling.

The role of roots in the uptake of nonessential trace metals by aquatic macrophytes was investigated using Elodea canadensis. Plants were grown in 2 lakes in which metal concentrations in the water differed. Specimens in each lake were anchored in either control sediment or in sediment contaminated with Cd and Pb. Plants grown in the same water but in sediment from different sources had significantly different concentrations of the 2 metals. Elodea samples rooted in sediments from the same source but grown in water with different levels of metals also accumulated significantly different amounts of Cd and Pb. Thus the importance of both sediment and the surrounding water as sources of metals for aquatic plants was demonstrated. Samples grown in water and sediments containing low levels of metals had minimal concentrations of 0.32 microg/g Cd and 5.2 microg/g Pb, while plants grown in metal-contaminated water and sediment accumulated up to 32.33 microg Cd/g and 160.9 micro Pb/g. (Katz)
W78-02696

PHYSIOLOGICAL RESPONSE OF JUVENILE STRIPED BASS, MORONE SAXATILIS, TO LOW LEVELS OF CADMIUM AND MERCURY,
National Marine Fisheries Service, Milford, CT. Experimental Biological Investigations.
M. A. Dawson, E. Gould, F. P. Thurberg, and A. Calabrese.
Chesapeake Science, Vol. 18, No. 4, p 353-359, December 1977. 2 fig, 2 tab, 29 ref.

Descriptors: *Cadmium, *Mercury, *Heavy metals, *Striped bass, *Bioassay, *Enzyme, Biochemistry, Environmental effects, *Fish physiology, Respiration, Animal physiology, Metals, Commercial fish, Sport fish, Bass, Estuarine fisheries, Inhibitors, Toxicity, Morone, Enzyme activity, Sublethal effects.

Juvenile striped bass, Morone saxatilis, were exposed to 0.5, 2.5, and 5.0 parts per billion (ppb) cadmium chloride for 30-90 days and to 1.0, 5.0, and 10.0 ppb mercury as mercuric chlorides for 30-120 days. Following the longest exposure to each metal, the fish were allowed to recover for 30 days in running seawater. Gill-tissue respiration, glucose-6-phosphatase, malic enzyme, aspartate aminotransferase, and magnesium activation of AAT were measured. Animals exposed to wither metal exhibited changes in gill-tissue respiration. There was no significant difference in enzyme activity during exposure to either metal; however, fish cleared for 30 days following exposure to cadmium exhibited a slight drop in liver AAT and G6PdH. (Katz)
W78-02697

EFFECT OF PHOSPHAMIDON ON HEPATIC AND RENAL CATALASE OF A FRESHWATER BONY FISH,
Orissa Univ. of Agriculture and Technology, Bhubaneswar (India).
P. C. Thomas, and T. L. Murthy.
Indian Journal of Fisheries, Vol. 21, No. 2, p 594-597, 1974. 1 tab, 10 ref.

Descriptors: *Organophosphorus compounds, *Pesticides, *Freshwater fish, *Fish physiology, *Toxicity, *Enzymes, *Organophosphorous pesticides, Organic compounds, Laboratory tests, Analytical techniques, Proteins, Biochemistry, Inhibitors, Metabolism, Inhibition, Enzymes, Phosphamidon, Tissue analysis, Catalases, Hepatic catalase, Renal catalase, Bioaccumulation.

Results obtained from invivo experiments indicated that catalase activity in liver and kidney were reduced remarkably by the action of phosphamidon. Invivo inhibition of hepatic and renal calase were 30.9% and 28.5% respectively. Studies on the invitro effect of phosphamidon (50 micro l/ml in the final dilution) indicated 53.9% and 65.3% inhibitions of the enzyme activity in the liver and kidney homogenates. It was concludes that phosphamidon was a partial inhibitor of the enzyme catalase. There was no significan change in hemoglobin content of blood from treated and control fishes. (Klein)
W78-02698

RELATIONSHIP OF SCARLET PRAWNS (PLESIOPENAEUS EDWARDSIANUS) TO A BENTHIC OIL DEPOSIT OFF THE NORTH-WEST COAST OF ARUBA, DUTCH WEST INDIES,
National Marine Fisheries Service, Miami, FL. Southeast Fisheries Center.
H. C. Thompson, Jr, R. N. Farragut, and M. H. Thompson.
Environmental Pollution, Vol. 13, p 239-253, 1977. 4 fig, 2 tab, 42 ref.

Descriptors: *Crustaceans, *Commercial shellfish, *Oil, *Oil pollution, *Organic compounds, Metabolism, Toxicity, Sampling, Benthos, Analytical techniques, Oil industry, Productivity, *Shrimp, Commercial shellfish, Scarlet prawns, Prawns, Plesiopenelaeus edwardsianus, Tissue analysis, Paraffins, Bioaccumulation, Dutch West Indies, Aruba.

Catch data resulting from sampling efforts off the north-west coast of Aruba, Dutch West Indies, demonstrated a greater catch rate of crustacea in areas where benthic oily material was collected as compared to adjacent areas where there was no oil. Scarlet prawns (Plesiopenaeus edwardsianus) were three times more abundant in the areas where benthic oil was found. They contained no isoprenoid hydrocarbons of the type common to most biological material or the type common to petroleum. However, they did contain an unusual n-paraffin hydrocarbon series (n-C22, n-C25, n-C28, n-C31, n-C34), and in the areas where the benthic oily material was collected the prawns contained much greater quantities of the five n-paraffins given in the above sequence. A probable explanation for the greater abundance of crustacea in the area affected by the oily material was discussed. The accumulation and metabolism of hydrocarbons by marine organisms and how these processes relate to scarlet prawns were also discussed. (Klein)
W78-02699

SILVER IN SOILS, STREAM SEDIMENTS, WATERS, AND VEGETATION NEAR A SILVER MINE AND TREATMENT PLANT AT MARATOTO, NEW ZEALAND,
Massey Univ., Palmerston North (New Zealand). Dept. of Chemistry, Biochemistry and Biophysics.
For primary bibliographic entry see Field 5B.
W78-02700

5D. Waste Treatment Processes

HIGH NITRATE DENTRIFICATION IN CONTINUOUS FLOW-STIRRED REACTORS,
Oak Ridge National Lab., TN.
C. W. Francis, and J. B. Mankin.
Water Research, Vol 11, No 3, p. 289-294, 1977. 4 fig, 3 tab, 14 ref.

Descriptors: *Nitrates, *Denitrification, *Waste water treatment, Kinetics, Continuous flow, Industrial wastes, Fuels, Waste treatment, Equations, Coal, Biological treatment, *Continuous flow-stirred reactors.

Continuous flow-stirred reactors were used to determine the maximum denitrification specific removal rate for NH4NO3, CaNO3, and UO2 solutions from fuel fabrication waste water. UO2 fuel fabrication plants using the ammonium diuranate UO2 recycling process may generate nitrate wastes as high as 25-50,000 g NO3/cu m. Biological denitrification in columns packed with fine particles of anthracite coal has been suggested as an effective method for nitrate removal from UO2 plant waste water. Denitrification kinetics are difficult to evaluate in such units because of the inverse relationship between the substrate nitrate concentration and the height of used to determine the maximum specific substrate nitrate concentration and the height of the upward flow column. Graphical solutions to the Lineweaver-Burk equations were mass per day (U sub max). For NH4No3 at nitrate substrate concentrations < 6 kg NO3/cu m, the value of U sub max was found to be 1.73/day. At concentrations > 6 kg NO3/cu m, a nonlinear relationship was observed, indicating nitrate substrate inhibition. Specific removal rates at nitrate concentrations > 6 kg NO3/cu m averaged < 1.0/day. Ammonia toxicity may have occurred, as the pH of the mixed liquor was near denitrification rates. (Lynch-Wisconsin)
W78-02217

TEMPERATURE EFFECTS ON BOD STOICHIMETRY AND OXYGEN UPTAKE RATE,
Caldwell Consulting Engineers, Walnut Creek, CA.
For primary bibliographic entry see Field 5B.
W78-02220

WASTEWATER TREATMENT AND REUSE BY THE SOIL-PLANT SYSTEM,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
J. R. Gilley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 595, Price codes: A02 in paper copy, A01 in microfiche. Nebraska Water Resources Center, Lincoln, Completion Report, October 1, 1977. 23 p, 6 fig, 6 tab, 6 ref. OWRT A-041-NEB(2), 14-34-0001-7058.

Descriptors: *Waste water disposal, *Water reuse, *Municipal wastes, Sewage effluents, Sprinkler irrigation, Infiltration, Waste water treatment, Irrigation practices, Land application, Soil profiles, Nitrogen.

An evaluation of irrigation management practices for land application of sewage effluent was made to determine the potential groundwater pollution by nitrate nitrogen resulting from effluent disposals. An average nitrogen removal rate of 58 percent was measured when applications (10.2 cm per week) well in excess of most crop needs were applied to soil columns with a layered soil profile. The layered soil profile created conditions favorable for the denitrification process which is important in minimizing the nitrogen movement to groundwater. No significant difference in nitrogen removal was obtained between treatments, when the application of 10.2 cm per week was divided among applications of one, two or five times a week. The frequency of applications in wastewater effluent would, therefore, be best determined by other factors such as problems with crop diseases, soil aeration and local climatic conditions.
W78-02223

U.S. ARMY CORPS OF ENGINEERS CLEVELAND-AKRON THREE RIVERS WATERSHED, WASTEWATER MANAGEMENT SURVEY SCOPE STUDY.
Wright-McLaughlin Engineers, Denver, CO.
For primary bibliographic entry see Field 5G.
W78-02233

HYDROGEN SULFIDE PROBLEMS,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 5F.
W78-02283

UNDERGROUND TANK USED FOR STORM WATER DETENTION.
For primary bibliographic entry see Field 8A.
W78-02296

WATER REUSE,
Irrigation Commission, Lucknow (India).
For primary bibliographic entry see Field 3C.
W78-02297

STORM OVERFLOW DESIGNERS NEED GREATER FEEDBACK.
For primary bibliographic entry see Field 5B.
W78-02298

SEWAGE COLLECTION SYSTEM RELIEVES THREAT TO FLORIDA OYSTER INDUSTRY.
For primary bibliographic entry see Field 5G.
W78-02301

SEA BED INSTALLATION FOR SEWAGE PIPELINE.
For primary bibliographic entry see Field 5E.
W78-02302

SEWERAGE OUTFALL PROTECTED.
For primary bibliographic entry see Field 8G.
W78-02303

CAN THIS SEWER PROJECT HAVE RECREATIONAL BENEFITS,
Board of Water and Sewer Commission, Northborough, MA.
For primary bibliographic entry see Field 5G.
W78-02304

AN OLD BRICK SEWER FINDS A SILVER LINING,
For primary bibliographic entry see Field 8G.
W78-02305

SEWER REHABILITATION CUTS INFILTRATION,
For primary bibliographic entry see Field 8G.
W78-02307

I/I STUDY TURNS TO T. V.,
Larkin and Associates, Kansas City, MO.
For primary bibliographic entry see Field 8G.
W78-02308

BENEFITS FROM GROUTING AN ENTIRE SEWER SYSTEM,
Lower Allen Township Authority, Camp Hill, PA.
For primary bibliographic entry see Field 8F.
W78-02309

BEAM BEHAVIOR OF BURIED RIGID PIPELINES,
California Univ., Berkeley. Sanitary Engineering Research Lab.
For primary bibliographic entry see Field 8B.
W78-02310

BEACH, HIGHWAY AND SEWER PLAN ROLLED INTO ONE.
For primary bibliographic entry see Field 8D.
W78-02311

SEWERS VERSUS SEWERLESS METHODS--A REPORT BY A CONGRESSIONAL COMMITTEE,
For primary bibliographic entry see Field 5G.
W78-02312

R7-M JOHANNESBURG SEWER TUNNEL.
For primary bibliographic entry see Field 8F.
W78-02313

PLASTIC LINED CONCRETE CHANNEL FOR WASTE WATER PURIFICN. PLANT - ASSEMBLED FROM PREFABRICATED MODULAR ELEMENTS WITH SEALED PLASTIC JOINTS.
For primary bibliographic entry see Field 8F.
W78-02315

BIOLOGICAL PURIFICATION OF INDUSTRIAL AND DOMESTIC WASTE WATER - BY PERIODIC FLOODING OF FILTRATION BEDS TO A SPECIFIED DEPTH.
Soviet Patent SU 529-128. Issued December 14, 1976. Derwent Soviet Inventions Illustrated, Vol. Y, No. 37, p 5, October, 1977.

Descriptors: *Biological treatment, *Filtration, *Patents, *Oxidation, *Self-purification, Filters, Aerobic treatment, Sewage lagoons, Waste water treatment, Flooding.

A waste water treatment process which involves periodic flooding of filtration beds for municipal and industrial wastes has been patented. During the flooding period waste water is applied to a depth of 0.5-1.0 m relative to the depth of the filter bed, to increase treatment efficiency and equalize winter and summer performance. In later stages waste water is applied at a rate of 0.2-0.3 m until the initial depth of 0.5-1.0 m is reached on a daily loading basis of 300-500 cu m/hectare. The periodic nature of the flooding preserves aerobic conditions, inhibits the growth of microorganisms and other aquatic life, and insures the presence of algae in the water. Oxidation and self-purification in the bed is continuous through summer and winter. (Schulz-FIRL)
W78-02316

WASTE WATER FILTRATION PROCESS - WHICH DOES NOT BLOCK THE FILTER, EFFECTED BY SEQUENTIAL ADDN OF ALUMINATE, SILICATE AND AMMONIUM/POLYVALENT CATION SOURCE.
French Patent FR 2334-632. Issued August 12, 1977. Derwent French Patents Abstracts, Vol. Y, No. 39, p 5, November, 1977.

Descriptors: *Filtration, *Alumina, *Filters, *Patents, *Silicates, Coagulation, Waste water treatment.

In a recently patented waste water filtration process, 0.004-0.04 moles/liter of an alkali aluminate are added to the waste water, followed by 0.006-0.2 moles/liter of an alkali silicate, 0.001-0.2 moles of a soluble ammonium source and/or a source of soluble Ca, Mg, Fe, Al, Ba, Co, Cd, Sr,

and/or Cu. The waste water should have a pH of more than 5.5 before any chemicals are added. The treatment process, which uses readily available chemicals, does not block the filter and produces a highly dewatered complex of recovered solids for safe storage, handling, and benefical use. The filtrate which is produced is free from particulate matter, many dissolved substances, and microorganisms. (Schulz-FIRL)
W78-02317

PHOSPHATE STRIPPING OF SEWAGE.
Australian Patent 485,436. Issued August 11, 1977. The Australian Official Journal of Patents, Trade Marks, and Designs, Vol. 47, No. 29, p 2674, August, 1977.

Descriptors: *Nutrient removal, *Activated sludge, *Phosphates, *Separation techniques, *Patents, Sludge treatment, Anaerobic conditions, Sewage treatment, Waste water treatment, *Phosphate removal.

A phosphate stripping process has been patented by the Union Carbide Corporation for use in conjunction with activated sludge treatment. Mixed liquor which includes phosphate-containing influent sewage and activated sludge passes through an aeration zone, where the BOD is reduced and microorganisms take up phosphate. The phosphate-enriched sludge is separated from the substantially phosphate-free supernatant and passed to a phosphate stripping zone, where anaerobic conditions are maintained to cause the release of the phosphate to the liquid phase of the settled sludge. The sludge containing the phosphate-enriched liquid is contacted with a lower phosphate content medium to remove the phosphate from the anaerobic sludge liquid phase. A portion of the sludge is returned to the phosphate stripping zone. (Schulz-FIRL)
W78-02318

GRAVITY DRAINAGE FILTER FOR SEWAGE SLUDGE ETC.--HAS SIMPLE UNBLOCKABLE OUTLET FOR DISCHARGING DEHYDRATED SLUDGE.
Belgian Patent BE 854-385. Issued September 1, 1977. Derwent Belgian Patents Abstracts, Vol. Y, No. 36, p 3, October, 1977.

Descriptors: *Filters, *Dewatering, *Sludge treatment, Equipment, *Patents, Filtration, Sewage treatment, Waste water treatment.

The gravity drainage filter which has been patented consists of a vertically suspended, flexible tube of porous material such as textile fabric. The bottom of the fabric sleeve can be closed to form a container into which the sludge is poured, and is equipped with a dehydrated sludge outlet which can be opened to a diameter equal to the full width of the sleeve. The sleeve extends below the container bottom which is created by the clamping of internal and external rigid reinforcing rings. The sleeve extension is folded back onto itself to form an annular pocket, with the outer edge of the pocket forming a border which is attached to a mobile support ring. Opening and closing of the container bottom is accomplished by rotation of the mobile support ring relative to the reinforcing rings. (Schulz-FIRL)
W78-02319

INVENTORY OF ENERGY USE IN WASTEWATER SLUDGE TREATMENT AND DISPOSAL,
For primary bibliographic entry see Field 5E.
W78-02320

FILTER SYSTEM SUCCESSFUL.
For primary bibliographic entry see Field 8C.
W78-02321

OXYGEN AERATION ADDS TREATMENT CAPACITY, UPS EFFICIENCY.
The American City and County, Vol 92, No 8, p 55-56, August, 1977.

Descriptors: *Aeration, *Dissolved oxygen, *Aerobic treatment, *Dissolved oxygen analyzers, *Aerated lagoons, Oxidation lagoons, Sewage treatment, Oxygenation, Equipment, Design data, Activated sludge, Waste water treatment, Oxygen aeration, Wayne(NJ), Detroit(MI).

Applications of the Arico F(3)O (Forced Free Fall Oxygen) system to sewage aeration are described. An Airco Model 1000 is being used at the Sheffield Hills waste water treatment plant in Wayne, New Jersey, to provide 1000 lbs of oxygen to two aeration basins. A gas-tight concrete module containing an axial flow pump, a system of weirs, and a nozzle is submerged in the covered aeration basin with the pump intake below the surface. Sewage is drawn downward into a distribution well and through a zone of oxygen-rich gas. Oxygenated mixed liquor is then returned to the aeration basin via a nozzle-like orifice at the base of the module, and unabsorbed oxygen is recycled through the module. High dissolved oxygen levels in the basin are maintained by continuous cycling through the module. A high-purity oxygen treatment system produced by the FMC Corporation for use in uncovered aeration basins is described. Oxygen is transferred to waste water by a horizontal rotating diffuser. Diffuser impellers maintain mixing and solids suspension and a dissolved oxygen probe monitors mixed liquor oxygenation in the FMC system. (Schulz-FIRL)
W78-02322

ELECTRIC EQUIPMENT FOR MUKOGAWA RIVER SEWAGE TREATMENT PLANT,
Hanshin City Improvement Bureau, Hyogo (Japan).
For primary bibliographic entry see Field 8C.
W78-02323

BASIC CONCEPTS IN DISINFECTION WITH OZONE,
Miami Univ., Coral Gables, FL. Dept. of Civil Engineering.
S. Farooq, E. S. K. Chian, and R. S. Engelbrecht.
Journal Water Pollution Control Federation, Vol 49, No 8, p 1818-1831, August, 1977. 14 fig, 1 tab, 24 ref.

Descriptors: *Ozone, *Disinfection, *Microorganisms, *Acid bacteria, *Mycobacterium, Sewage bacteria, Activated sludge, Yeasts, Sewage treatment, Sludge treatment, *Waste water treatment, Candida parapsilosis, Mycobacterium fortuitum, Ozonation.

Inactivation studies with Candida parapsilosis and Mycobacterium fortuitum were conducted to examine the various parameters which might affect the disinfection efficiency of ozone in continuous flow systems. Parameters examined include pH, mixing, density of organisms, and organic matter. Results of laboratory studies indicated that the ozone residual in waste water controlled the degree of inactivation of microorganisms and that the presence of ozone bubbles enhanced disinfection. Greater ozone stability at low pH aided inactivation. Decreases in inactivation with more intense mixing were attributed to lower ozone residuals. Ozone demand and organism survival were greater at a high density of organisms, with more efficient disinfection at low densities. Studies on secondary waste water effluent with different fractions of organic material indicated that secondary effluents exerted much higher ozone demands than the deionized-buffered water which had been seeded with microorganisms for the laboratory studies. Greater ozone demands were observed for waste water which contained organic compounds with molecular weights in the fulvic acid range (150-18,000) than in the humic acid range (less than 150 or greater than 18,000). Low food:microorganism ratio in an activated sludge unit resulted in more efficient ozone disinfection. (Schulz-FIRL)
W78-02324

REDUCTION OF SALMONELLA, E. COLI, COLIFORMS AND FECAL STREPTOCOCCI BY CHLORINATION OF SEWAGE TREATMENT PLANT EFFLUENTS,
Rijksinstituut voor de Volksgezondheid, Bilthoven (Netherlands). Lab. voor Stralingsonderzoek.
E. H. Kampelmacher, A. W. Fonds, and L. M. Van Noorle Jansen.
Water Research, Vol 11, No 7, p 545-550, 1977. 9 tab, 5 ref.

Descriptors: *Salmonella, *Coliforms, *Streptococcus, *Chlorination, E coli, Sewage bacteria, Sewage treatment, Disinfection, Bioassay, Pollutant identification, Effluents, *Waste water treatment.

The reduction in bacteria during chlorination and phosphate removal was investigated for three sewage treatment plants in the Netherlands (Harderwijk, Elburg, and Bunschoten-Spakenburg). Influent samples from the facilities were monitored for Salmonella; effluent samples were measured for Salmonella, Escherichia coli, coliforms, and fecal streptococci. Concentrations of various Salmonella serotypes found in influent at the three facilities are listed. Concentrations of the serotypes in effluent before and after chlorination and in the receiving lake are presented. Disinfection efficiencies for Salmonella varied for the three plants, with the plant at Bunschoten-Spakenburg having the highest reduction (2.22 logs). The reductions in E. coli, coliforms, and fecal coliforms at the three plants were similar, and were dependent on the total residual chlorine content of the effluent. MPN's of E. coli, coliforms, and fecal streptococci in effluent before and after chlorination are presented for the three facilities. (Schulz-FIRL)
W78-02325

BATCH AEROBIC TREATMENT OF A COLLOIDAL WASTEWATER,
Worcester Polytechnic Inst., MA. Dept. of Civil Engineering.
H. A. Kharajian, and J. H. Sherrard.
Journal Water Pollution Control Federation, Vol 49, No 9, p 1985-1992, September, 1977. 6 fig, 2 tab, 9 ref.

Descriptors: *Activated sludge, *Stabilization, *Degradation(Decomposition), *Aerobic treatment, *Colloids, Chemical oxygen demand, Biodegradation, Organic loading, Oxygen requirements, Flocculation, Analytical techniques, Biological treatment, Sludge treatment, *Waste water treatment, Contact stabilization.

Treatment with contact stabilization, a modification of the activated sludge process, is normally indicated for waste water containing a large percentage of colloidal organic matter. Since the percentage of colloids may indicate that contact stabilization processes are necessary for a given facility, studies were conducted to determine whether there was a substantial release of substrate after an initial rapid uptake. Batch experiments were used to examine the biodegradation of waste water as a function of its percentage of colloidal material, based on a test for chemical oxygen demand. Colloid concentrations of 0, 23, 43 and 54% were prepared by adding beef extract and yogurt to synthetic sludge. Initial loading conditions were 0.158-1.083 mg/liter COD per mg/liter MLSS. Samples collected at various time intervals were analyzed for COD, MLSS, and oxygen uptake. No immediate uptake and substantial organic material were noted with concentrations under 54%. Biodegradation was similar to that of the soluble substrate. (Schulz-FIRL)

W78-02326

DALLAS PAYS THE PRICE OF CLEANER EFFLUENT,
Dallas Water Utilities Dept., TX.
I. M. Rice, and C. A. Mauck.
Water and Wastes Engineering, Vol 14, No 9, p 42-45, September, 1977.

Descriptors: *Activated sludge, *Filtration, *Tertiary treatment, *Trickling filters, *Settling basins, Aeration, Biological treatment, Aerobic treatment, Treatment facilities, Texas, Equipment, Municipal wastes, *Waste water treatment, Dallas(TX).

The 1-mgd Dallas Wastewater Reclamation Research Center was constructed to provide design data for an advanced waste water treatment plant needed by the city of Dallas. Data obtained during the first year of operation of the Research Center indicated that treatment with the completely-mixed activated sludge process, followed by filtration before discharge into the Trinity River, was probably the most economical and efficient method of treatment for the proposed expanded facilities at the Dallas Central Wastewater Treatment Plant. In the expansion of the Central plant from a capacity of 100 mgd with secondary treatment to a capacity of 150 mgd with tertiary treatment, the addition of the completely-mixed activated sludge process followed by mixed media filters resulted in an effluent with less than 10 mg/liter BOD and 10 mg/liter total suspended solids. A 180-mgd capacity pumping station pumps effluent from the secondary treatment facility to a series of splitter boxes which divert the flow to 12 aeration basins. Each 70 x 26-ft aeration basin is equipped with four 75-hp mechanical surface aerators. Twelve associated sedimentation basins which remove the suspended solids are equipped with scum and sludge removal equipment. A 4.5-million-gal aerobic digester treats waste activated sludge and scum from the sedimentation basins. An emergency settling basin was constructed to provide 5 hrs of additional settling time under high flow conditions. Chemically treated effluent is filtered with 14 mixed media filters before discharge to the Trinity River at the White Rock pump station. (Schulz-FIRL)
W78-02328

FOREWORD, OZONE SYMPOSIUM,
Air Products and Chemicals, Inc., Allentown, PA.
J. C. Tao, and C. S. McDowell.
AIChE Symposium Series, Vol 73, No 166, p 186-187, 1977. 10 ref.

Descriptors: *Ozone, *Disinfection, *Chemical reactions, *Chlorination, *Toxicity, Municipal wastes, Industrial wastes, Environmental effects, *Waste water treatment.

Various aspects of the use of ozone for disinfection of municipal and industrial waste water are discussed. The possible toxicity and carcinogenicity of compounds produced during chlorination have led to research into alternative means of disinfection. Studies on chemical reactions occurring between waste water constituents and ozone and on the environmental effects of ozonated effluents are described. The effects of pH, temperature, and the presence of ammonia in the waste water on ozone disinfection efficiency are discussed. The use of ultraviolet light or ultrasound in conjunction with ozone to degrade organic materials is described for waste waters which contain particularly toxic or resistant substances. Design criteria, cost-effectiveness, and disinfection efficiency requirements which may influence the application of ozone as a disinfectant are discussed. (Schulz-FIRL)
W78-02329

EFFECT OF SEWAGE TREATMENT BY STABILIZATION POND METHOD ON THE SURVIVAL OF INTESTINAL PARASITES,
King Inst. of Preventive Medicine, Gindy (India).
K. M. Veerannan.
Indian Journal of Environmental Health, Vol 19, No 2, p 100-106, April, 1977. 1 tab, 24 ref.

Descriptors: *Animal parasites, *Sewage treatment, *Oxidation lagoons, *Disinfection, *Public health, Sewage lagoons, Treatment facilities, On-site data collections, Waste water treatment, Madras(India), Entamoeba coli, Entamoeba histolytica, Ascaris lumbricoides, Enterobius vermicularis, Giardia lambia.

The survival of pathogenic intestinal parasitic protozoans and helminths in sewage stabilization ponds was evaluated in a sampling program at three stabilization pond sites near Madras, India. Each pond held waste water from a different source: a tuberculosis sanatorium, the Indian Institute of Technology, and the Kodungaiyur sewage farm. Composite samples of sewage before and after treatment were collected bi-weekly throughout the study. Concentrations of Entamoeba coli, Entamoeba histolytica, Giardia lambia, Ascaris lumbricoides, and Enterobius vermicularis were measured in samples of pond influent and effluent. The study results indicated that the concentration of protozoan cysts and ova varied up to 844/liter and that removal efficiencies ranged from 38.5% at the Indian Institute of Technology to 100% at the sanitorium. A comparison of relative removal efficiencies for various organisms indicated the stabilization pond at the sanitorium in Tambaram was more efficient at removing protozoan cysts, while the pond at Kodungaiyur was more efficient at removing helminthic ova. (Schulz-FIRL)
W78-02330

PROCESS ARRANGEMENTS FOR ION EXCHANGE AND ADSORPTION,
California Univ., Berkeley. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5F.
W78-02331

JET FLUID GAS/LIQUID CONTACTING AND MIXING,
Houdaille Industries, Inc., Ceder Falls IA. Penberthy Div.
M. G. Mandt, and P. R. Bathija.
AIChE Symposium Series, Vol. 73, No. 167, p 15-22, 1977. 9 fig, 8 ref.

Descriptors: *Aeration, *Mixing, *Eddies, *Circulation, Equipment, Mass transfer, Flow measurement, Gases, Bubbles, Aerobic treatment, Mathematical studies, Model studies, Equations, Waste water treatment, Jet mixers, Jet gas/liquid contactors, Directional mix jet systems.

The use of jet gas/liquid contactors in tank mixing systems to enhance the gas-liquid interface was investigated in a testing program with the Eddy Mix Jet System. The system consists of a series of gas jets mounted in a radial pattern or cluster on the unit. A plume in which small bubbles have been entrained is injected into the mixing tank. The plume momentum produces eddy currents which force tank turnover and increase mass transfer. The Eddy Mix Jet System was evaluated in a testing facility equipped with 12-, 30-, and 55-ft diameter tanks. Flow velocity was measured at various jet submergence depths and air flow rates. A series of equations to describe flow characteristics in the basin with respect to basin design, jet position, and operating parameters are presented. An example in which the expected turn time, total pumpage, and average velocity are calculated is presented for a 50-ft diameter basin with a 22-ft side water depth and a 12-jet cluster. The directional mix jet system in which jet gas/liquid contactors are arranged longitudinally along the axis of a closed loop flow channel is described. A series of equations to estimate channel velocity at given operating parameters and design data is presented. A method for calculating the total loss coefficient is presented. (Schulz-FIRL)
W78-02332

EPA RELAXES ITS STANDARDS ON SEWAGE SETTLING PONDS.
For primary bibliographic entry see Field 5G.
W78-02333

SOLID-LIQUID SEPARATION: AN OVERVIEW,
Houston Univ., TX. Dept. of Chemical-Petroleum Engineering.
For primary bibliographic entry see Field 5G.
W78-02334

UV-OX(TM) PROCESS FOR THE EFFECTIVE REMOVAL OF ORGANICS IN WASTEWATERS,
Westgate Research Corp., Marina del Rey, CA.
J. D. Zeff.
AIChE Symposium Series, Vol. 73, No. 167, p 206-220, 1977. 8 fig, 5 tab, 7 ref.

Descriptors: *Ozone, *Oxidation, *Irradiation, *Ultraviolet radiation, *Organic wastes, Urea, Pilot plants, Design data, Disinfection, Tertiary treatment, Operation and maintenance, Industrial wastes, Municipal wastes, Water treatment, Waste water treatment.

The UV-OX(tm) process was developed for the oxidation of dissolved organics, particularly refractory organic compounds in waste water. The process is based on a combined ozonation-irradiation process. The water is agitated at high speed and irradiated by 253.7-nm UV light which is also used to produce ozone. Background information is presented for various methods of decomposition and oxidation, including photochemical decomposition, ozone oxidation, ionic oxidation, free radical oxidation, and ultraviolet-ozone oxidation. Laboratory tests are used to evaluate the system for the degradation of selected organic compounds, including hydroquinone, pyrogallol, xylenol, sodium acetate, and urea. Batch and continuous tests are conducted with a modified reactor and synthetic waste water. The process efficiency was measured in terms of the amount of energy required to completely oxidize each mg of carbon per liter. Process variables which may affect performance include residence time, ozone concentration, ozone mass flow, ultraviolet intensity, and total organic carbon concentration. A stimulated, two-stage continuous system was used to determine the maximum total organic carbon efficiency:ozone efficiency with minimum expenditures of ultraviolet energy. The effects of ultraviolet intensity and the reactor diameter were also examined. An evaluation of process scale-up requirements indicated that to treat 100,000 gal/day, 210 reactor units with six 43-watt lamps per unit would be required and daily operating costs would be approximately $72.33. (Schulz-FIRL)
W78-02335

BIOLOGICALLY ACTIVE FILTER COMBINED WITH ENZYME TREATMENT,
MicroChem Development Lab., Stockholm (Sweden).
M. E. Refaat.
AIChE Symposium Series, Vol. 73, No. 167, p 166-171, 1977. 2 fig, 2 tab, 8 ref.

Descriptors: *Filtration, *Porous media, *Trickling filters, *Enzymes, *Catalysts, Anaerobic conditions, Biological treatment, Filters, Biochemical oxygen demand, Chemical oxygen demand, Municipal wastes, Industrial wastes, *Waste water treatment, Anaerobic fiber bundle filter, Extracellular enzymes.

A waste water treatment process in which anaerobic treatment is improved by the addition of a rapid enzyme-enhanced filter is described. The process is based on the anaerobic fiber bundle filter, a packed bed of individual fibers supported at the top of the filter. The low-weight fiber bundle material can be used in beds up to 120 cm in height without the need for supporting intermediate partitions. In comparison to the conventional stone media used in trickling filters, the fibrous material has a surface area 2-3 times greater, and due to the large free volume can handle high organic loadings. Extracellular enzymes added to the filter act as catalysts during the anaerobic processes. Municipal wastes, waste activated sludge, and waste water from a polyvinyl acetate manufacturing plant were used in an evaluation of the anaerobic filter system. The construction of the filter reactor, fiber pretreatment, enzyme production, operating parameters, cleaning, and analyses of filtrate are described. COD, BOD, and turbidity in the filtrate were used to evaluate filter performance. Tests with the enzyme-anaerobic filter system indicated that flow resistance did not increase during filter operation and that the stabilization capacity of the system was 9.1 g COD/sq m per hr. The addition of extracellular enzymes increased both the BOD and COD removal rates. The BOD in the filter bed decreased with depth and the COD fluctuated, indicating continuous biologic activity through the filter. (Schulz-FIRL)
W78-02336

DEWATERING MACHINE SOLVES SLUDGE DRYING PROBLEMS,
Water Pollution Control Dept. Medford, NJ.
B. W. Eichmann.
Water and Sewage Works, Vol. 124, No. 10, p 99-100, October, 1977. 1 tab.

Descriptors: *Filters, *Dewatering, *Sludge treatment, *Filtration, Equipment, Flocculation, Suspended solids, Costs, Municipal wastes, Waste water treatment, Sludge dewatering, Belt filter press, Coil spring vacuum filter, Medford Township(NJ).

Medford Township, New Jersey, has installed a belt filter press to dewater aerobically digested sludge resulting from contact stabilization. The waste water treatment plant in Medford includes two 500,000-gpd contact stabilization units to handle a flow of 0.9 mgd. The belt filter press, Flocpress, manufactured by Infilco Degremont Inc. of Richmond, Virginia, is used in addition to an existing coil spring vacuum filter which was left in place for emergency situations. The installation of the Flocpress allowed dewatering of sludge in one shift 3-4 days per week. The belt filter press results in 98% solids capture with a filtrate suspended solids of less than 100 ppm as compared to 1000-2000 ppm produced with the coil filter. Flocpress also requires a smaller dosage and horsepower for operation than the coil filter. In the dewatering process, polymer conditioned sludge is fed to the flocculator and is then spread across a slow-moving, woven synthetic fiber belt. After compression, a flexible scraper or doctor blade removes the sludge from the conveyor belt. Schematic diagrams for the Flocpress sludge dewatering unit and the sludge handling system are presented. An operating log for 1976 is presented for sludge quantities handled, costs, and polymer dosages. (Schulz-FIRL)
W78-02337

SOLAR ENERGY USED TO CONVERT WASTEWATER TO PROTEIN.
Water and Wastes Engineering, Vol. 14, No. 10, p 37, October, 1977.

Descriptors: *Feeds, *Algae, *Sewage treatment, *Oxidation lagoons, *Photosynthesis, *Nutrient removal, Pulp wastes, Pilot plants, Australia, Waste water treatment, *Proteins, Algae harvesting.

Brown and Caldwell has developed a system in which a waste water substrate and solar energy are used to produce a high-quality single cell protein harvested in the form of algae and a usable liquid effluent. Primary treated waste water is subjected to secondary treatment in shallow, high-rate oxidation ponds and the resulting algae is harvested with a device which uses a paper-precoated filter to entrap the dense algae product. In a year-long study in Melbourne, Australia, the initial objective was to use waste paper for the harvester belt fabric; used belts were then recycled as a composite feed for ruminant livestock, the paper providing roughage and energy and the algae providing protein. The algae-laden paper product was reported as having a protein content of 15% by weight. Problems associated with the smaller size of individual algae cells produced in winter and with the high cost of waste paper in Australia led to the development of a two-stage vacuum and rinsing cycle for the separation of algae from pond effluent. In this case a concentrated algae slurry is produced rather than a dried, algae-laden paper. The algae recovery system is recommended for situations where feed supplies are in demand and high-quality sewage treatment is indicated. (Schulz-FIRL)
W78-02338

RADIATION TREATMENT OF SLUDGE TO BE EXPLORED.
For primary bibliographic entry see Field 5E.
W78-02339

ORE. PLANT WILL MEET REQUIREMENTS.
Water and Wastes Engineering, Vol. 14, No. 10, p 77, October, 1977.

Descriptors: *Activated sludge, *Treatment facilities, *Trickling filters, *Energy, *Design data, Flocculation, Heat exchangers, Sludge treatment, Sewage treatment, Municipal wastes, Waste water treatment, Corvallis(OR).

The Corvallis municipal waste water treatment plant in the Willamette Valley in Oregon has been designed by Brown and Caldwell to meet effluent discharge requirements which call for not more than 10 mg/liter of BOD or suspended solids in treated effluents. In the treatment process at Corvallis diffused-air activated sludge process is designed for operation in three modes: sludge reaeration, step-feed, and conventional activated sludge. Existing trickling filters were incorporated into the activated sludge system to protect the system from shock loads. The secondary clarifiers are equipped with centerwell flocculators. An alum feed system is provided to insure adequate sludge settling characteristics. Energy requirements were considered in the design of the plant, and a heat recovery coil in the aeration air blower discharge line is used to provide heat in the operation and maintenance building. The plant has a design capacity of 10 mgd, which was created with hydraulic designs allowing the addition of the activated sludge process to increase the design flow rate from 5 to 10 mgd without repumping. (Schulz-FIRL)
W78-02340

DYE-SENSITIZED PHOTO-OXIDATION--A NEW APPROACH TO THE TREATMENT OF ORGANIC MATTER IN SEWAGE EFFLUENTS,
Volcani Inst. of Agricultural Research, Bet-Dagen (Israel). Dept. of Soil and Water.
A. J. Acher, and I. Rosenthal.
Water Research, Vol. 11, No. 7, p 557-562, 1977. 4 fig, 1 tab, 15 ref.

Descriptors: *Oxidation, *Organic wastes, *Chemical oxidation demand, *Dyes, *Solar radiation, Energy transfer, Bentonite, Coliforms, Effluents, Disinfection, Arid climates, Semiarid climates, *Waste water treatment, Photo-oxidation, Rose bengal, Methylene blue, Dye-sensitized photo-oxidation, Israel.

Sewage treatment with dye-sensitized photo-oxidation may be competitive with other methods of oxidation in climates with a large number of sunlight hours per day. The general mechanism of photo-oxidation by the combined action of visible light ant molecular oxygen on organic matter is described. Effluents from circulated oxidation ponds at municipal waste treatment plants in Haifa, Tel Aviv, and Nazareth in Israel were used in experiments on photo-oxidation with rose bengal (RB) and methylene blue (MB) as dye sensitizers. COD, fecal coliform counts, and suspended solids were used to evaluate oxidation efficiency. Initial experiments on the reduction of COD by the exposure of aerated sewage to solar radiation resulted in higher COD reductions with MB. A concentration of MB of 12 mg/liter resulted in the minimum COD values of 120 in sunlight and 112 in ultraviolet radiation. Decreases in removal efficiency above 15 mg MB/liter were attributed to reduced light penetration in the darker medium. Less effective removal below 10 mg MB/liter was attributed to decreases in the dissolved MB concentration by physical adsorption and chemical reactions. Studies on the effect of radiation time indicated that COD levels were constant after 60 min, and that coliforms were completely destroyed after 30 min. MB was successfully removed from treated effluent by adsorption onto bentonite. (Schulz-FIRL)
W78-02341

USE OF OZONE IN THE DISINFECTION OF COLIPHAGE T-7 VIRUS,
Abbott Labs., Crystal Lake, IL.
For primary bibliographic entry see Field 5F.
W78-02343

COMPOUNDS RESISTANT TO CARBON ADSORPTION IN MUNICIPAL WASTEWATER TREATMENT,
Weyerhauser Co., Tacoma, WA.
For primary bibliographic entry see Field 5A.
W78-02344

PRETREATMENT AND CLEANING OF HYPERFILTRATION (REVERSE OSMOSIS) MEMBRANES IN MUNICIPAL WASTEWATER RENOVATION,
Hebrew Univ., Jerusalem (Israel). Graduate School of Applied Science and Technology.
G. Belfort.
Desalination, Vol. 21, No. 3, p 285-300, September, 1977. 2 fig, 2 tab, 56 ref.

Descriptors: *Membrane processes, *Reverse osmosis, *Tertiary treatment, *Water reuse, *Operation and maintenance, Filtration, Membranes, Transport depletion, Osmosis, Municipal wastes, Liquid wastes, Waste water treatment.

Substances contained in municipal waste water such as BOD, COD, TOC, and suspended solids can contribute to membrane fouling when using reverse osmosis or hyperfiltration as a means of treating waste water for reuse. Alternative methods for pretreatment and cleaning of membrane surfaces used in municipal waste water treatment to reduce effects associated with fouling or flux decline in reverse osmosis are reviewed. The roles that various municipal waste water constituents play in membrane fouling are described. Pretreatment methods which can be used to remove hazardous constituents from the feed to extend membrane life include pH adjustments, chemical coagulation, filtration, activated carbon adsorption, chlorination, and ultrafiltration. Geometric considerations which may affect membrane operations are discussed, including brine channel dimensions, the shear rate at the membrane-brine interface, and the ease of cleaning for the various commercially available module designs. Criteria used in the selection of membranes for hyperfiltration are described for various types of waste water. Product-flux decline of

hyperfiltration membranes may be caused by membrane hydrolysis, compaction, and fouling. Physical, chemical, and other techniques for membrane cleaning are described. (Schulz-FIRL)
W78-02345

PHYSICOCHEMICALLY-AIDED BIOLOGICAL TREATMENT OF SEWAGE,
Bostock, Hill and Rigby, Birmingham (England).
S. H. Jenkins, M. Sane, and T. Wallbank.
Chemistry and Industry, Vol. 20, p 821-834, October, 1977. 13 fig, 9 tab, 13 ref.

Descriptors: *Activated sludge, *Lime, *Coagulation, *Pilot plants, *Tertiary treatment, Activated carbon, Magnesium, Color, Filtration, Heavy metals, Nutrient removal, Industrial wastes, Municipal wastes, *Waste water treatment, Manchester(UK).

A pilot plant for physicochemically-aided biological treatment at the Davyhulme Works in Manchester, England, was constructed to handle an average waste water flow of 382,000 cu m/day, of which 100,000 cu m/day is of industrial origin. Process units in the seven modes of operation tested include primary sedimentation with sludge extraction; activated sludge treatment; final clarification; flash mixing and flocculation facilities for pH control and chemical coagulation; intermediate clarification; activated carbon adsorption; automatic pH control with lime and HCl; provisions for the addition of at least three chemical coagulants at any one time; automatic sampling of raw and treated waste water throughout the plant; and primary and secondry sludge holding vessels. After a viable activated sludge process was established, studies focused on tertiary treatment of activated sludge effluent and the effects of lime and magnesium on sewage. Primary and tertiary lime sludges and return activated sludges produced during various modes of operation were measured for dry solids content, heavy metals, capillary suction time, filtration resistance, and volume. Tertiary treatment of the activated sludge effluent included sand filtration and activated carbon adsorption. Results of operation of the pilot plant from August 1975 to February 1977 are presented. Studies on lime addition indicated that addition of lime to raw sewage was more effective at reducing BOD, COD, and suspended solids in the final effluent than addition to activated sludge effluent. Removal of heavy metals, ammonia, and phosphorus were also investigated during various stages of treatment. (Schulz-FIRL)
W78-02346

CONTACT FILTRATION FOR PHOSPHORUS REMOVAL,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
M. Kavanaugh, J. Eugster, A. Weber, and M. Boller.
Journal Water Pollution Control Federation, Vol. 49, No. 10, p 2157-2171, October, 1977. 8 fig, 6 tab, 25 ref.

Descriptors: *Filtration, *Nutrient removal, Phosphorus, *Porous media, *Chemical precipitation, Flocculation, Polymers, Suspended solids, Filters, Flow rates, SeparatioN technique, Municipal wastes, *Waste water treatment, Contact filtration, *Phosphorus removal.

Pilot studies on the use of granular media filtration for removal of particulate phosphorus and organic carbon following mechanical-biological treatment are presented. Objectives of the studies were to examine the effects of filter media design, filtration rate, and chemical addition on the performance of granular media filters used for phosphate removal following precipitation; and to evaluate process feasibility of contact filtration for municipal waste water treatment. The study concluded that contact filtration was a viable alternative to coagulation/sedimentation or flotation, but the permissible influent filter solids concentration was dependent on the individual situation. The addition of a polyelectrolyte such as a non-ionic polymer was necessary to increase the shear resistance of flocculant solids to produce adequate solids retention. Solids removal with the three-layer and two dual-media filters was greater than 95% in runs of approximately 6 hr. Removal efficiencies were increased with an increase in the upper:lower medium depth ratio which produced a decrease in the time-averaged rate of headloss increase. Inverse relationships were observed between filtration rate/break through time and the time to exhaust available head. Sand, anthracite, and pumice comprised the media used in the three-layer filter, and sand-anthracite and sand-Magnofilt were used in the dual-media filters. Of the media tested the porous granular solids, pumice and Magnofilt, exhibited lower solids capacities than anthracite at a given filtration rate and size fraction. (Schulz-FIRL)
W78-02347

FACTORS INFLUENCING ACTIVATED SLUDGE PROPERTIES,
Missouri Univ.-Columbia. Dept. of Civil Engineering.
J. T. Novak, H. Becker, and A. Zurow.
Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol. 103, No. EE5, p 815-828, October, 1977. 17 fig, 30 ref.

Descriptors: *Dewatering, *Sludge treatment, *Polymers, *Coagulation, *Filtration, Activated sludge, Chemical reactions, Aeration, Dissolved oxygen, Clays, Particle size, Waste water treatment.

In studies with sludge conditioners, cationic polymers greatly improved sludge filtration rates while anionic polymers decreased rates, indicating that activated sludge probably contained an excess of anionic polymers. An increase in filtration rate with additions of kaolinite which was more apparent with fine clay than coarse clay suggested that the anionic polymers were of large enough molecular weight for interparticle bridging. Aeration of the activated sludge initially improved filtration rate and decreased the concentration of extractable biopolymers. Studies conducted to develop a method for estimating polymer concentrations in solution on the basis of electrophoretic mobility indicated that maximum filtration rates occurred with zero colloid charge, and that the optimal polymer dose was dependent only on the supernatant liquor volume and not on the sludge solids concentration. Aeration of activated sludge in a plug flow basin was used to examine the effects of anaerobiosis on sludge characteristics. Data suggested tha anaerobiosis increased polymer concentrations and decreased filtration rates. The lower optimal cationic polymer dose and filtration times observed during aeration with oxygen instead of air verified the influence of dissolved oxygen concentrations in aeration basins on the natural polymer decay rate. Experiments on sludge thickening indicated that calcium carbonate and clay were capable of drastically increasing sludge settling velocities, and that every method of sludge conditioning to improve filtration also improved sludge settling. (Schulz-FIRL)
W78-02348

NEW SLUDGE DIGESTORS AT MARITZBURG.
The Civil Engineer in South Africa, Vol. 19, No. 9, p 195-196, August, 1977.

Descriptors: *Treatment facilities, *Sludge digestion, *Construction materials, *Design data, *Sludge treatment, Sewage treatment, Foreign countries, Equipment, Waste water treatment.

International Combustion (Africa) Ltd. was contracted by the city of Pietermaritzburg in South Africa to design and construct facilities to increase the capacity of the Darvill Sewage Purification Works from a dry-weather flow of 27 million liters/day to a capacity of 54 million liters/day, with provisions for later expansion to 117 million liters/day. Since conventional sludge digestion followed by drying beds required too much land and was ineffective during periods of high rainfall in the area, high-rate digestion of sludge and treatment of settled sludge by activated sludge processes were chosen. The facility includes two 9-story high, 4500-cu-m, high-rate digestors which were developed by Messrs Oswald Schultze of Germany and constructed by Bridge and Structures Ltd. The egg-shaped design of the digestors and the fact that they will be completely filled at all times should minimize scum formation. Construction of the digestors was accomplished in three stages: a lower conical section below ground, a median double-curved section, and an upper conical super structure. A six-sector shuttering system was used to pour the double-curved section. The method designed by Messrs Oswald Schultze uses an internal curved shutter, springing from a central trunnion axis with adjustable jacks to locate the inner curve of the surface. The digestors utilize a sludge retention time of 26 days, injection of influent raw sludge into the continuously circulating flow of heated sludge, and recovery of methane. (Schulz-FIRL)
W78-02349

PUMP APPLICATIONS IN SEWAGE SLUDGE DEWATERING PROCESSES,
For primary bibliographic entry see Field 8C.
W78-02350

AREAWIDE WASTEWATER MANAGEMENT FOR METROPOLITAN DES MOINES,
Kirkham Michael and Associates, Omaha, NE.
For primary bibliographic entry see Field 5G.
W78-02351

LIQUID WASTE EFFLUENT INSTALLATION UNVEILED IN FLA.
For primary bibliographic entry see Field 5E.
W78-02352

IMPROVING SLUDGE FILTER PERFORMANCE.
Water and Waste Treatment, Vol. 20, No. 9, p 36, September, 1977. 1 fig.

Descriptors: *Filtration, *Filters, *Sludge treatment, *Dewatering, *Flocculation, Sewage treatment, Equipment, Waste water treatment, Performance.

Chemical conditioning has been used to reduce sludge volume so that sludge dewatering equipment can be used to its full potential. Laporte Industries Ltd. in Widnes, England, provides two flocculants, aluminum chlorohydrate and Lapofloc P.A.C., for use in the water and waste water treatment industries at 15% (w/w) and 10% (w/w) A1303, respectively. Lapofloc, a polyelectrolyte, is suggested for use with secondary sludges. Conditioning of sludge on a rotary vacuum filter designed to use aluminum chlorohydrate with 2.6% A1203 and 10% lime provided a yield of 1.8 lg/sq ft/hr, while conditioning with Lapofloc at a dose level of 1.5% A1203 produced a cake discharge of 2.5 lb/sq ft/hr. The addition of hydrogen peroxide, available from Interox Chemicals Ltd., a joint Laporte-Solvay company, suggested for alleviation of problems associated with the production of hydrogen sulfide during sludge handling. (Schulz-FIRL)
W78-02353

HOSPITAL'S WASTE.
For primary bibliographic entry see Field 8C.
W78-02354

MAINE'S PERSPECTIVE ON COMPOSTING TOILETS AND ALTERNATE GREYWATER SYSTEMS,
Maine Dept. of Human Services, Augusta. Div. of Health Engineering.
For primary bibliographic entry see Field 5E.
W78-02355

FACTORY-BUILT PLANTS AID EXPANSION PLANS,
Reclamation Center, Carol Stream, IL.
G. Schnulle.
Public Works, Vol. 108, No. 11, p 73-74, November, 1977. 1 fig.

Descriptors: *Activated sludge, *Treatment facilities, *Water reuse, *Construction materials, Filters, Tertiary treatment, Municipal wastes, Industrial wastes, Waste water treatment.

Three steel factory-built units manufactured by Smith and Loveless Division of Ecodyne Corporation were used in the construction of waste water treatment facilities which included secondary treatment followed by tertiary treatment with filtration. Each unit includes an activated sludge contact-stabilization chamber and integral arrangements for sludge reaeration, settling, and aerobic digestion. The units, which have capacities of 1.0, 1.0, and 0.5 mgd, were designed with concentric circular shells. After aeration and retention for 4-5 hrs, waste water flows by gravity to a clarifier in the center of each unit where it is retained for 4-5 hrs. The settled sludge is then pumped to either the aerobic digester or reaeration section. Clarifier overflow passes to one of three concrete settling tanks and then to one of six dual-media filters which contain anthracite and sand. Filter backwash is recycled through the plant and the effluent is disinfected with chlorination before discharge to Klein Creek. A belt filter press with an integral chemical conditioning unit is used to dewater the sludge to a solids concentration of 10-12%. The sludge cake is disposed by landfilling. While the domestic wastewater has an average BOD of 250 mg/liter and suspended solids of 200 mg/liter, the plant also receives 0.7 mgd of waste water at a BOD of 350 mg/liter from a nearby industrial park which includes a jam and jelly manufacturer. BOD and suspended solids in the final effluent average 1-2 mg/liter, and ammonia about 0.4 mg/liter. (Schulz-FIRL)
W78-02356

KEEP YOUR DIGESTER IN GOOD SHAPE,
Church and Dwight Co., Inc., Piscataway, NJ.
N. R. Barber.
Water and Waste Engineering, Vol. 14, No. 9, p 55, 59, September, 1977. 1 fig.

Descriptors: *Anaerobic digestion, *Chemical reactions, *Chemical precipitation, *Sludge treatment, Lime, Hydrogen ion concentration, Alkalinity, Toxicity, Sludge digestion, Waste water treatment.

Sodium bicarbonate has been used to safeguard against chemical malfunction of anaerobic digestion caused by the accumulation of volatile acids and carbon dioxide. Since NaHCO3 can directly shift the equilibrium to any desired value without first reacting with soluble CO2, it has been used as an alternative to lime, which can produce undesirable side effects such as vacuum and/or precipitation. With lime addition, the removal of CO2 from the digester head room to replenish the CO2 taken out of the solution can create an instantaneous vacuum which places stresses on tank structures. This may, in turn, allow oxygen to enter the system with resulting toxicity to the anaerobic organisms in the digester. Scale formation due to the precipitation of CaCO3 after it reaches its solubility limit can also present problems. An equation representing the increase in bicarbonate alkalinity caused by the reaction of lime with soluble CO2 is presented. Calculations indicated that scale formation is likely at CaCO3 concentrations greater than 500 mg/liter or at lime concentrations greater than 370 mg/liter. An equation to estimate the required alkalinity for buffering the pH at different levels of CO2 partial pressure is presented. NaHCO3, a natural pH control buffer in all aqueous systems, has a toxicity level in anaerobic digestion systems of 0.2 moles Na/liter for slug wastes when other ions are at concentrations below 10 mg/liter. The presence of antagonistic ions such as K and Ca may increase the tolerable level of Na to digester organisms. (Schulz-FIRL)
W78-02357

BIG SQUEEZE FOR SLUDGE KEEPS CAKE ON THE GO.
New Scientist, Vol. 76, No. 1077, p 349, November, 1977.

Descriptors: *Filters, *Dewatering, Equipment, *Filtration, *Sludge treatment, Flocculation, Sludge disposal, Waste water treatment.

Edward and Jones of Stoke-on-Trent in England have developed a continuous filter press for large-scale dewatering of slurries encountered in the sewage treatment industry. A flocculating agent is first used to create small solid particle aggregates in the sludge to facilitate dewatering. The slurry is then screened with a rotating drum equipped with fine mesh steel walls to produce a slurry solid enough for handling on a moving belt. The second stage of dewatering is accomplished by sludge compression between two belts and two sets of rollers. During the third and final stage of dewatering, the sludge passes between two caterpillar tracks made of PBC slats. High-pressure hydraulic jacks compress the upper track, which runs on rollers attached to a moveable frame, against the lower track which is mounted on rollers attached to a rigid frame. The hydraulic sludge press is reported to produce a sludge cake of comparable consistency to that produced by a conventional filter press. (Schulz-FIRL)
W78-02358

ANTIGONISH CHOOSES AERATED LAGOONS FOR WASTEWATER TREATMENT SYSTEM,
Office of the Mayor, Antigonish (Nova Scotia).
C. H. Chisholm.
Water and Pollution Control, Vol. 115, No. 9, p 25-26, September, 1977.

Descriptors: *Aeration, *Treatment facilities, *Oxidation lagoons, *Sewage lagoons, Sewage treatment, Odor, Design data, Municipal wastes, *Waste water treatment.

A. H. Roy and Associates Ltd. have designed a 1-mgd waste water treatment facility for the town of Antigonish in Nova Scotia, Canada. A system of three aerated lagoons was chosen for the 18-acre available site which would provide sewage treatment for the town's 6,000 residents, for the 4,000 residents of St. Francis Xavier University, and for other nearby towns. Designed for a BOD loading of 1700 lb/day, the combined capacity of the three lagoons is 29.6 million gal with an average retention time of 29.6 days to allow for shock conditions created by storm water flows. The 10-ft deep lagoons provide a total surface of 9.8 acres, the first lagoon being the largest at 3.5 acres with bottom dimensions of 250 x 508 ft. Aeration of the system is accomplished by three 25-hp blowers with one of the units serving as a standby. The town managed the $518,000 project, saving well over $100,000 in construction costs by hiring nine specialized contractors for individual phases of the project. Problems with odor after start-up were alleviated by removal of grease which had accumulated on the surface of the first lagoon. Blower noise was muffled by the installation of a sound plenum in the air intake. Operation of the aerated lagoon system has improved the water quality of the West River and Antigonish Harbor. (Schulz-FIRL)
W78-02359

REACTOR CLARIFIERS.
For primary bibliographic entry see Field 5F.
W78-02360

EFFECTS OF SODIUM BENTONITE AND FERRIC CHLORIDE ON ACTIVATED SLUDGE TREATMENT OF WASTEWATER,
Arya-Mehr Univ., of Technology, Tehran (Iran). Biochemical and Bioenvironmental Research Center.
A. Mirzadeh, Y. Maeda, and A. Fazeli.
Journal of Fermentation Technology, Vol 55, No 3, p 258-264, 1977. 4 fig, 4 tab, 17 ref.

Descriptors: *Activated sludge, *Bentonite, *Chlorides, *Iron compounds, *Flocculation, Microorganisms, Respiration, Oxygen demand, Settling basins, *Sludge treatment, Clays, Waste water treatment.

The enhancement of microbial flocculation in the activated sludge system by the addition of sodium bentonite and ferric chloride was investigated in batch and continuous tests with activated sludge and artificial sewage. Sodium bentonite and ferric chloride were added to mixed liquor in an aeration tank and the oxygen uptake rate of the activated sludge was monitored. Other parameters examined include specific filtration resistance, sludge volume index, settling rate, and the specific substrate (COD) utilization rate. The addition of sodium bentonite did not significantly affect the sludge respiration activity. The loss of sodium bentonite was reduced by the addition of ferric chloride, enhancing the settling rate, filtration resistance, and sludge volume index. Reductions in substrate utilization rates and activated sludge volume index. Reductions in substrate utilization rates and activated sludge respiration with the addition of ferric chloride were attributed to physiological effects on sludge bacteria and protozoa. Although the use of bentonite and ferric chloride did not significantly enhance microbial flocculation, the data obtained in this study may be useful in the treatment of wastes which contain these chemicals. (Schulz-FIRL)
W78-02361

CATALYTIC OZONATION IN AQUEOUS SYSTEM,
Southern Illinois Univ. at Carbondale.
J. H. Chen, C. Hui, T. Keller, and G. Smith.
AIChE Symposium Series, Vol 73, No 167, p 206-212, 1977. 14 fig, 1 tab, 9 ref.

Descriptors: *Ozone, *Oxidation, *Catalysts, *Chemical oxygen demand, *Iron oxides, Chemical reactions, Model studies, Phenols, Disinfection, Organic wastes, Industrial wastes, Waste water treatment.

A steady-state packed bed reactor was used in the investigation of catalytic ozonation with Fe203 as a catalyst for municipal and industrial waste waters. Dilute solutions of phenol and ethyl acetoacetate were used to simulate wastes, and TOC and COD were continuously monitored in the liquid effluent. The system was run at various gas flow rates, ozone concentrations, liquid retention times, and feed concentrations. Studies with aqueous phenol solutions indicated that removal efficiency increased with retention time and decreased with influent COD concentrations. Operating conditions for a percentage of COD removal equal to the percentage of ozone consumed were an ozone concentration of 16 mg/liter and a liquid retention time of 33 min, or at 30 mg/liter and 20 min. The stoichiometric relationship for ozonation of aqueous phenols is presented as 1 mole of C6H50H and 14 moles of 03 yielding 6 moles of CO2, 3 moles of H20, and 14 moles of 02. Experiments on catalytic ozonation of industrial wastes supplied by Nalco Chemical Company

were conducted with wastes which had a TOC of 459 mg/liter and a pH of 6.8. Analyses of TOC in the ozonated effluent indicated that the presence of a catalyst during exposure to ozone significantly enhanced TOC removal. (Schulz-FIRL)
W78-02362

CITY REAPS INCOME FROM SLUDGE PROCESSING SYSTEM,
For primary bibliographic entry see Field 5E.
W78-02363

CHIPPING NORTON STW -- INAUGURATION OF CONTRACT.
Water Services, Vol 81, No 978, p 454, August, 1977.

Descriptors: *Treatment facilities, *Sewage treatment, *Costs, *Sludge treatment, *Municipal wastes, Oxidation, Aeration, Storm water, Suspended solids, Biochemical oxygen demand, Waste water treatment.

The Chipping Norton sewage treatment works are being constructed for the Thames Water Authority at a cost of more than 500,000 pounds. Principal contractor for the facility which will provide sewage treatment for a population of 13,000 is Kimbell Construction Ltd. of South Northampton, England. The facility should produce effluent with a BOD of 15 mg/liter and suspended solids of 12 mg/liter. The plant will incorporate new sludge pressing facilities completed earlier in 1977. The proposed Chipping Norton plant includes preliminary treatment, an aeration ditch, circular storm and settling tanks, a storm irrigation area, and various pumping stations. Whitehead and Poole Ltd. is the principal mechanical contractor for the project. Screw pumps and tank scrapers will be provided by New Haden Pumps. The pista grit trap and classifier are produced by Jones and Attwood Ltd. and the sludge pump by Pegson Ltd. The booster set to be used at the plant is manufactured by Megator Pumps and Compressors Ltd. Scheduled for completion in the latter part of 1978, the new facility will completely replace the existing works. (Schulz-FIRL)
W78-02364

POLIO-VIRUS ADSORPTION FROM WATER ONTO SILICATE MINERALS,
Maine Univ. at Orono. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5F.
W78-02365

INFLUENCE OF TEMPERATURE AND U.V. LIGHT ON DISINFECTION WITH OZONE,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5F.
W78-02366

SPECTROPHOTOMETRIC DETERMINATION OF RESIDUAL HYDROGEN PEROXIDE,
Brussels Intercommunal Water Co., (Belgium).
For primary bibliographic entry see Field 5A.
W78-02367

EVALUATION OF A NITRATE-SPECIFIC ION ELECTRODE,
University of Southern California, Los Angeles. Environmental Engineering Program.
For primary bibliographic entry see Field 5A.
W78-02368

CHEMICAL REGENERATION OF GRANULAR ACTIVATED CARBON,
Rome Univ. (Italy). Ist. di Chimica Fisica ed Elettrochimica.
M. Beccari, A. E. Paolini, and G. Variali.
Effluent and Water Treatment Journal, Vol 17, No 6, p 290-294, June, 1977. 4 fig, 4 tab, 20 ref.

Descriptors: *Adsorption, *Activated carbon, *Chemical properties, *Thermodynamics, *Kinetics, Thermodynamic behavior, Enthalpy, Tertiary treatment, Separation techniques, Chemical reactions, Waste water treatment, Chemical oxygen demand, Activated carbon regeneration, Desorption.

Regeneration of the adsorption capacities of granular activated carbon which had been exhausted by peptone was investigated. Peptone solutions with various COD levels were percolated through beds of activated carbon. Tests were carried out at 20C and 30C. Langmuir and Freundlich isotherms relating the COD of the solution and the weight of adsorbate and adsorbent with equilibrium conditions were calculated. Batch and continuous testing procedures were outlined. Thermodynamic analysis and adsorption isotherms indicated that the relationship between adsorbate and adsorbent followed the van't Hoff-Arrhenius equation with a change in enthalpy of -6.36 kcal/mole. An examination of adsorption kinetics revealed that the rate-limiting step was intraparticle diffusion. Regenerating capacities were measured for various oxidizing and non-oxidizing agents. In batch tests, oxidants did not have appreciable chemical regenerating abilities, while non-oxidizing agents exhibited regenerative efficiencies of not more than 50%. The extractive capacities of non-oxidizing agents were improved by alkaline pretreatment at 80C, with alkaline pretreatment itself having an extractive efficiency of 50%. Continuous studies with several regenerative cycles showed a decrease in regenerative efficiency after the first two cycles. (Schulz-FIRL)
W78-02369

THE PROMISES OF ION EXCHANGE,
Shell Development Co., Houston, TX.
For primary bibliographic entry see Field 5F.
W78-02371

WOONSOCKET, RHODE ISLAND SEEKS SOLUTION TO ALUM SLUDGE DISPOSAL PROBLEM,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5E.
W78-02372

COMPUTERS AND INSTRUMENTATION--PARTNERS IN TREATMENT PLANT OPERATION,
For primary bibliographic entry see Field 7C.
W78-02373

A MORE PRECISE METHOD OF DETERMINATION OF SPECIFIC RESISTANCE TO FILTRATION,
For primary bibliographic entry see Field 7B.
W78-02374

LEVEL INSTRUMENTATION IN EFFLUENT TREATMENT PLANTS.
For primary bibliographic entry see Field 5A.
W78-02375

MASS TRANSFER AND MIXING IN THE KENICS AERATION SYSTEM,
Kenics Corp., North Andover, MA.
S. J. Chen, and R. G. Gilbert.
AIChE Symposium Series, Vol. 73, No. 167, p 23-32, 1977. 11 fig, 3 tab, 11 ref.

Descriptors: *Aeration, *Oxygenation, Equipment, *Analytical techniques, *Dissolved oxygen, Model studies, Mathematical studies, *Mass transfer, Activated sludge, Dissolved oxygen analyzers, Municipal wastes, Industrial wastes, Waste water treatment, *Mixing, Aeration system performance.

The full-scale test facility used in the evaluation of the Kenics Aeration System includes a 38.5-ft dia, 32-ft deep cylindrical steel tank; an aeration system with 46 Kenics aerators; a 2000-scfm rotary positive; a distribution piping system; air flow meters; a chemical feed system for deoxygenation; and dissolved oxygen analyzers. Oxygen transfer efficiency is measured with the clean water sodium sulfite method. Four methods of analysis used to evaluate oxygen transfer efficiency are described: direct analysis, exponential curve fitting, the rapid estimate (time constant) technique, and log deficit (semilog). An equation for the standard oxygenation rate (SOR) is presented. The analytical techniques were tested in three aeration tests under conditions representing a typical completely-mixed activated sludge aeration system. Methods for determining direct pumping capacity and mixing are described. Field tests to determine the solids suspension characteristics of Kenics Aeration Systems are described. An expression for oxygen transfer as a function of SOR and the wire or line electric horsepower (LHP) is presented. (Schulz-FIRL)
W78-02376

MASS TRANSFER IN LARGE SECONDARY TREATMENT AERATORS,
V. W. Uhl, R. L. Winter, and E. L. Heimark.
AIChE Symposium Series, Vol. 73, No. 167, p 33-41, 1977. 6 fig, 5 tab, 17 ref.

Descriptors: *Mass transfer, *Oxygenation, *Aeration, *Model studies, Mathematical studies, Analytical techniques, Dissolved oxygen analyzers, Absorption, Waste water treatment.

A 40-ft square basin filled to a depth of 20 ft with tap water was used in studies to provide values for oxygen uptake rate and mass transfer coefficient for large-scale aeration systems such as those used in secondary waste water treatment. Procedures for power consumption tests and oxygen transfer measurements are described. Tests with the aeration basin were run at mixer drive output speeds of 30 and 56 RPM; with impellers of 66 in, 72 in, 75 in, 122 in diameters; and with blower gas rates from 280 to 1570 scfm. Regression analyses of semi-log plots of the oxygen saturation deficit data acquired during 18 tests were used to calculate mass transfer coefficients. Five correlation schemes incorporating various configurations of gas turbine input, liquid volume, impeller speed, superficial gas velocity, impeller shaft torque, and impeller discharge rate were evaluated in terms of yielding a 'best fit' for the experimental data. An optimization procedure to maximize the amount of oxygen transferred in lb/hr per total horsepower is presented. (Schulz-FIRL)
W78-02377

INVESTIGATION OF MUTAGENIC EFFECTS OF PRODUCTS OF OZONATION REACTIONS IN WATER,
Environmental Protection Agency, Washington, DC. Office of Water Supply.
For primary bibliographic entry see Field 5F.
W78-02378

APPLICATION OF THE RAPID LYSINE DECARBOXYLASE TEST FOR EARLY ISOLATION AND DETECTION OF SALMONELLAE IN SEWAGE AND OTHER WASTEWATERS,
National Environmental Engineering Research Inst., Nagpur (India). Life Sciences Div.
For primary bibliographic entry see Field 5A.
W78-02379

COMPUTER CONTROL OF LARGE-SCALE WASTEWATER TREATMENT PLANT,
Tokyo Sewerage Bureau (Japan).
S. Kato, R. Nagasaki, T. Ohto, S. Nogita, and M. Tanuma.
Hitachi Review, Vol. 26, No. 7, p 229-234, 1977. 10 fig, 6 ref.

Descriptors: *Automation, *Dissolved oxygen analyzers, *Mathematical models, *Computer control, *Data processing, Dissolved oxygen, Data storage and retrieval, Activated sludge, Aeration, Pumping, Butterfly valves, Waste water treatment, Tokyo(Japan).

Results of experiments with analog and digital DO/air control systems conducted at the Mikawashima activated sludge treatment plant in Tokyo, Japan, are presented. The analog control system includes a controller with proportional and integral functions, a valve-opening control element, and a power-actuated butterfly valve. Studies on DO control with the analog system for four parallel aeration tanks resulted in DO values within 0.3 mg/liter of the desired value of 2 mg/liter. Lower control precision at 4 mg/liter DO was attributed to nonlinear characteristics of the butterfly valve. Functions of the MINIDIC direct digital control system used in the study includes filtering of input data, feed-forward control based on a flow meter, feedback compensation of valve opening angle, feedback control based on a DO meter, and compensation of nonlinear characteristics between valve opening angle and flow rate. Experiments with the digital controller were conducted with MLSS levels of 1,000 or 2,000 mg/liter and DO levels of 2, 4, and 6 mg/liter. The digital controller was effective in reducing valve actuating frequency to one-fifth of the frequency when the analog controller was used. The AQUAMAX-80F system, a computer control system for a large-scale waste water treatment plant, has been devised by Hitachi Ltd. of Japan for controlling flow rate, electrical devices, and water quality and for providing a data bank of treatment plant operations. Three mathematical models are presented for use in feed-forward control and waste water treatment process stimulation, including models for water quality, transparency, and dissolved organic matter concentrations. (Schulz-FIRL)
W78-02380

OZONE EFFECT ON NITROGENOUS MATTER IN EFFLUENTS,
Technion - Israel Inst. of Tech., Haifa. Dept. of Civil Engineering.
N. Narkis, A. M. Wachs, and M. Schneider.
Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol. 103, No. EE5, p 877-891, October, 1977. 6 fig, 7 tab, 16 ref.

Descriptors: *Nitrification, *Ozone, Analytical techniques, *Chemical reactions, *Nitrogen compounds, Ammonia, Nitrates, Nutrient removal, Chemical oxygen demand, Disinfection, Laboratory tests, Hydrogen ion concentration, Lime, Oxidation, Waste water treatment.

Experiments with lime-treated effluent from a biological municipal waste water treatment plant and solutions of nitrogenous compounds were used to examine the effects of ozone on nitrogenous matter in effluents. The pH of the solutions was adjusted to values from 2.8 to 12.2 and ozonation was carried out at a concentration of 20 mg 03/liter 02, a gas mixture flow rate of 0.4 liter/min, and contact periods of 15-120 min. In studies with lime-treated secondary effluents, ozonation produced nitrates which never increased above a concentration of 12 mg/liter, and total oxidation of organic nitrogen and ammonia was not achieved. At pH values below 6 nitrates were not produced, while nitrification increased significantly above pH 9 to reach a plateau level of 8.0 mg/liter beyond pH 10. The buffering capacity of lime treatment lowered the pH of the effluent during ozonation and inhibited nitrification. Increasing the length of the ozonation period decreased TKN, ammonia-N, and organic-N with a concurrent increase in nitrates in the treated effluent. Studies on the effects of the presence of ammonia on COD removal indicated that the oxidation of ammonia during ozonation did not affect the degree of removal nor the oxidation of organic compounds responsible for COD in the lime-treated effluent. The effects of ozonation on specific nitrogenous compounds in aqueous solutions were examined in experiments with NaNO2, NH4Cl, amino acid leucine solutions, borate and phosphate buffers, and bovine serum albumin. (Schulz-FIRL)
W78-02381

SONICATION OF ACTIVATED SLUDGE FLOCS AND THE RECOVERY OF THEIR BACTERIA ON SOLID MEDIA,
York Univ. (England). Dept. of Biology.
C. J. Banks, and I. Walker.
Journal of General Microbiology, Vol. 98, No. 2, p 363-368, February, 1977. 5 fig, 1 tab, 12 ref.

Descriptors: *Sewage bacteria, *Activated sludge, *Ultrasonics, *Analytical techniques, *Microorganisms, Sludge treatment, Municipal wastes, Separation techniques, Water analysis, Waste water treatment.

Since the enumeration of activated sludge bacteria is dependent on the ability to release them undamaged from sludge, the optimal conditions for bacteria recovery were investigated with ultrasound and sludges grown under different nutrient and hydraulic conditions. Samples of mixed liquor from the aeration tanks of an activated sludge plant were diluted and sonicated for periods ranging from 20 to 240 sec at five different intensities. Floc breakage was assessed according to the absorbence of the supernatant at 400 and 610 nm. Changes in temperature were used as a measure of energy input, and plating techniques were used to quantify the release of viable organisms during floc disruption. Experiments indicated that floc breakage depended on the intensity rather than the duration of sonic input, although bacteria release was controlled by intensity and duration. A sonication period of 80-100 sec at an intensity of 26 J/sec yielded the most viable bacteria. Measurements of the heating effect of sonication indicated that the creation of temperatures lethal to bacteria was unlikely, since sonication over 140 sec at maximum power output only increased the temperature from 0 to 13C. Bacteria determinations conducted in diluted sonicated mixed liquor from six municipal treatment works with CGY, MP, and TGEVA agars indicated that recovery was dependent on the particular sludge and its suspended solids and viable bacteria count. (Schulz-FIRL)
W78-02384

STUDY OF A SEPTIC TANK SYSTEM ON A LAKE SHORE: TEMPERATURE AND EFFLUENT FLOW PATTERNS,
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.
For primary bibliographic entry see Field 5B.
W78-02385

LOW-TEMPERATURE ORGANIC REMOVAL AND DENITRIFICATION IN ACTIVATED CARBON COLUMNS,
McMaster Univ., Hamilton (Ontario). Dept. of Chemical Engineering.
R. Maqsood, and A. Benedek.
Journal Water Pollution Control Federation, Vol 49, No 10, p 2107-2117, October, 1977. 14 fig, 6 tab, 17 ref.

Descriptors: *Bacteria, *Activated carbon, *Pilot plants, *Filtration, *Denitrification, Temperature, Nutrient removal, Organic compounds, Microorganisms, Sewage bacteria, Mathematical models, Sewage treatment, Waste water treatment.

Results of parallel pilot studies at 5 and 25C on low-temperature organic removal and denitrification in activated carbon columns are presented, with special emphasis on the monitoring of microbial life in activated carbon columns and the mathematical modelling of these columns in the presence of biooxidation. A series of equations are presented for the modelling of fixed-bed adsorbers in the presence of bacterial activity. Results of pilot studies at the Dundas Water Pollution Control Center indicated that physical-chemical treatment with granular activated carbon columns was capable of delivering high quality effluents at both temperatures examined and that microbial degradation enhanced the adsorptive capacities of the carbon columns. Dentrification was observed in the inside aerobic beds, and anaerobic bioactivity was attributed to localized flow conditions in pockets within the columns. The higher treatment efficiency at 25C was attributed to the greater proliferation of bacterial life in the column at higher temperatures. Studies on bacterial densities indicated that concentrations were similar to that of mixed liquor in an activated sludge plant. Denitrification rates were increased by at least 25% with the addition of organic substrate in studies with methanol addition in plastic media and GAC fluidized beds. The study concluded that the removal of organics by activated carbon was a biological rather than a physico-chemical phenomenon and that bacterial action did, in fact, prolong the life of the carbon bed. (Schulz-FIRL)
W78-02386

OPTIMAL CONTROL OF SEWAGE AND RAIN PUMPS BASED ON INFLUENT FLOW PREDICTION,
Tokyo Sewerage Bureau (Japan).
For primary bibliographic entry see Field 8C.
W78-02387

DYNAMO 1: A COST EFFECTIVE SOLUTION TO TREATMENT PROBLEMS,
Weston Environmental Consultants-Designers, Richmond, VA.
For primary bibliographic entry see Field 5G.
W78-02389

SURVEY FORECASTS FLOOD IN 1978 SEWERAGE MARKET.
For primary bibliographic entry see Field 5G.
W78-02393

RISING SEWAGE PLANT OPERATION COSTS BEG ENGINEERED SOLUTIONS.
For primary bibliographic entry see Field 5G.
W78-02394

CONCRETE FORMING FOR WATER AND WASTE TREATMENT PLANTS.
For primary bibliographic entry see Field 8F.
W78-02395

ADVANCED SEWAGE TREATMENT PLANTS, AN EPA PLANNING FLOP.
For primary bibliographic entry see Field 5G.
W78-02396

AGAT SEWAGE TREATMENT PLANT: IMPACT OF SECONDARY TREATED EFFLUENT ON GUAM COASTAL WATERS,
Guam Univ., Agana. Water Resources Research Center.
For primary bibliographic entry see Field 5C.
W78-02398

REGIONAL PLANNING FOR LAND APPLICATION OF WASTEWATER,
Pirnie (Malcolm), Inc., White Plains, NY.
For primary bibliographic entry see Field 5E.
W78-02439

A CLOSED WATER REUSE SYSTEM FOR POWER PLANT COOLING AND DIGESTER HEATING,
Nihon Suido Consultants Co., Tokyo.

For primary bibliographic entry see Field 3E.
W78-02443

COMPARING DESIGN MODELS FOR ACTIVATED SLUDGE,
Oklahoma State Univ., Stillwater. Bioenvironmental Engineering Labs.
A. F. Gaudy, Jr., and D. F. Kincannon.
Water and Sewage Works, Vol 124, No 2, p 66-70, February 1977. 1 fig, 7 tab, 16 ref.

Descriptors: *Waste water treatment, *Water quality, *Activated sludge, *Model studies, Design, Biomass, Aeration, Data collections, Equations, Operations research, Design, *Model comparisons, Substrate balance.

Secondary biological treatment processes, such as activated sludge, have the major responsibility for meeting stricter effluent standards regarding organic pollutants and treated wastewaters. Designers have therefore been migrating away from older 'rules of thumb' techniques and have been recognizing the need for employment of models which attempt to describe the functional behavior of the process. A comparison of the similarities and differences among four of these models is presented. The models are identified according to the names of the investigators who had major rules in their development: (1) Eckenfelder; (2) McKinney; (3) Lawrence and McCarty; and (4) Gaudy. Discussed are substrate balance and biomass balance. Compared are the reactor size and excess sludge production according to each model. It is concluded that there are no tremendous differences in required reactor volume or sludge production, but that there are indeed differences in the models which may affect their usefulness as operational and design tools and which may affect their utility in predicting effluent quality under changing environmental conditions. (Bell-Cornell)
W78-02449

FACTORS AFFECTING THE DENITRIFICATION RATE IN TWO WATER-SEDIMENT SYSTEMS,
Agricultural Univ., Wageningen (Netherlands).
J. F. Van Kessel.
Water Research, Vol 11, No 3, p 259-267, 1977. 9 fig, 4 tab, 33 ref.

Descriptors: *Denitrification, *Sediments, *Waste water treatment, Dissolved oxygen, Nitrates, Nitrites, Nitrogen, Effluents, Waste water(Pollution), Agricultural runoff, Nutrients, Water temperature, Slurries, Nitrification, Sediment thickness, Sediment nitrification.

Denitrification in a water-sediment system is affected by temperature, dissolved oxygen and nitrate concentrations in the water overlying the sediment, and the thickness of the sediment layer; the process is known to be strongly impaired by oxygen at approximate neutrality. These factors were tested in laboratory experiments using sediments from the 10 cm upper layer and water from two ditches. Effluent from a meat slurry purification plant (consisting of an activated sludge aeration tank and final clarification tank) was discharged into ditch A; ditch B received runoff from arable land. At 4C denitrification started after a prolonged lag period; nitrification did not occur to a significant degree. At 15C and particularly at 25C both processes proceeded rapidly. Increasing the dissolved oxygen concentration in the overlying water from zero to about 2 mg/l reduced the denitrification rate slightly, but a further increase in dissolved oxygen had no effect. The denitrification rates in both types A and B were dependent on the nitrate concentrations in the overlying water, at lower concentrations approximating first order kinetics, and gradually becoming independent of the nitrate concentration at higher nitrate content (zero order kinetics). With a nitrate-nitrogen concentration of 25.2 mg/l, a sediment layer of roughly 7 mm with A and 14 mm with B was found to be involved in denitrification. (Lynch-Wisconsin)
W78-02460

AQUATIC NITROGEN DETERMINATIONS IN REAL-TIME,
Connecticut Univ., Storrs. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W78-02515

PL 92-500 V. POLLUTION BY IRRIGATION RETURN FLOW,
National Enforcement Investigations Center, Denver, CO.
For primary bibliographic entry see Field 5G.
W78-02524

COMBINED BIOLOGICAL TREATMENT AND UNDERGROUND INJECTION OF REFINERY WASTE WATER,
Energy Research and Development Administration, Bartlesville, OK. Bartlesville Energy Research Center.
F. D. Sutterfield, E. C. Donaldson, and F. S. Manning.
Available from the National Technical Information Service, Springfield, VA 22161 as CONF 750530 4, Price codes: A03 in paper copy, A01 in microfiche. Presented at 2nd National Conference on Complete Water Reuse: Water's Interface with Energy, Air, and Solids, May 4-8, 1975, Chicago, Illinois. 27 p, 6 fig, 6 tab, 7 ref.

Descriptors: *Oil wastes, *Waste water treatment, *Injection wells, *Activated sludge, Waste disposal, Aeration, Costs, *Biological treatment, *Refinery wastes, Refineries.

A combination refinery waste processing system involving both biological treatment and deep well injection is described in this report. The majority of the waste (6.3 million gallons per day) is handled through an aeration basin capable of treating BOD-5, ammonia, and sulfide concentrations of 150, 20, and 10 ppm respectively. The remaining 0.4 million gallons of waste containing ammonia, mercaptans, phenol and sulfides with a 4,000 ppm BOD-5 are injected into a 7,000-foot-deep geologic formation. This latter portion is not readily amenable to activated sludge treatment because of the presence of compounds which are toxic to the functional bacteria maintained in activated sludge systems. The injection system has operated for several years without any major difficulties. Until it becomes technically and more economically feasible to treat this high-concentration, noxious mixture for discharge to surface waters, underground injection seems to offer the best solution for disposal. (Eberle-NWWA)
W78-02548

TECHNOLOGICAL ECONOMICS APPLIED TO WASTE RECOVERY AND TREATMENT PROCESSES,
Aston Univ., Birmingham (England). Dept. of Chemical Engineering.
A. V. Bridgwater.
Effluent and Water Treatment Journal, Vol 17, No 7, p 337-347, July 1977. 2 fig, 5 tab, 7 ref.

Descriptors: *Estimated costs, *Capital costs, *Treatment facilities, Waste water treatment, Costs, Methodology, Recycling, Lang factor, Equipment costs, Waste recovery processes.

Methods of cost estimation are applied to waste recovery and treatment processes. One of the most widely established methods, used at both the preliminary stage and for more detailed estimates, is based on multiplying the cost of main equipment by factors to take account of all the additional costs, such as installation, instrumentation, electricals, civil engineering and supervision. Detailed studies of a wide range of chemical processes have shown that the equipment cost is invariably the largest single item and all other costs could be related to this cost. The total of all individual factors for each element of capital cost is known as the Land factor. The factor method of estimating requires an estimate of the delivered equipment cost of the main equipment items. This means a detailed mass balance and equipment schedule is required. Such information may be obtained from a variety of sources, including published information and in-company sources. A representative cost list is presented, with cost stated in pounds, and a number of estimation examples are given, incorporating short cut methods. (Coyle-Wisconsin)
W78-02563

DEVELOPMENT DOCUMENT FOR EFFLUENT LIMITATIONS GUIDELINES AND NEW SOURCE PERFORMANCE STANDARDS FOR THE FISH MEAL, SALMON, BOTTOM FISH, CLAM, OYSTER, SARDINE, SCALLOP, HERRING, AND ABALONE SEGMENT OF THE CANNED AND PRESERVED FISH AND SEAFOOD PROCESSING INDUSTRY POINT SOURCE CATEGORY,
Environmental Protection Agency, Washington, DC. Effluent Guidelines Div.
For primary bibliographic entry see Field 5G.
W78-02578

SUPPLEMENTAL AERATION SYSTEM DESIGN FOR THE HOUSTON SHIP CHANNEL,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W78-02645

RESEARCH PROGRAM ON HAZARD PRIORITY RANKING OF MANUFACTURED CHEMICALS (CHEMICALS 21-40),
Stanford Research Inst., Menlo Park, CA.
For primary bibliographic entry see Field 5A.
W78-02659

CONSIDERATION OF SUSPENDED SOLIDS TRANSPORT IN ACTIVATED SLUDGE SYSTEMS SYNTHESIS: II. TOWER TYPE OF ACTIVATED SLUDGE SYSTEMS,
Kansas State Univ., Manhattan.
L. E. Erickson, J. C. Heydweiller, and L. T. Fan.
AIChE Symposium Series, Vol. 73, No. 167, p 112-134, 1977. 7 fig, 4 tab, 9 ref.

Descriptors: *Activated sludge, *Model studies, *Mathematical models, *Analytical techniques, Simulation analysis, Engineering, Design criteria, Biological treatment, Sewage treatment, *Waste water treatment.

The optimal structure and process designs for a co-current multi-stage aeration tower and a secondary clarifier were examined in model studies with the structural parameter method of system synthesis. Schematic diagrams of an activated sludge system with one, two, and three tower stages are presented. A series of equations for mass balances with respect to substrate concentration, flow rates, organism concentration, specific growth rate, and other parameters for each stage is presented. Computation aspects of the model, such as the choice of independent variables, dependent variable constraints, and input requirements, are discussed. A set of dimensionless, nonlinear algebraic equations is derived through the introduction of a series of dimensionless variables into the mass balance equation for organism concentration, substrate concentration, settling velocity, backflow rate, saturation, endogenous organism attrition rate, time, and the linear dispersion equation constant. The effects of the number of tower stages on the clarifier, fermentor, and total volumes are illustrated, as are the fraction of

the system volume allocated to the tower fermentor, and the sludge recycle and wasting rates. Analyses indicated that the three tower stage system achieved the desired effluent quality with the smallest tower, clarifier, and total volumes, and that the fraction of organic waste which was metabolized also increased as the number of tower stages increased. The amount of suspended solids in the overflow increased as the number of tower stages increased. (Schulz-FIRL)
W78-02661

LAB MODERNIZATION CREATES NEW PROBLEMS FOR PLANT OPERATORS,
Water Quality Lab., Las Cruces, NM.
For primary bibliographic entry see Field 5A.
W78-02662

WATER QUALITY MANAGEMENT–PROBLEM AREAS IN SEWERAGE AND SEWAGE DISPOSAL,
Thames Water Authority, London (England). Vales Div.
For primary bibliographic entry see Field 5E.
W78-02663

HEAT EXCHANGE METHOD FOR WET OXIDATION SYSTEMS,
Whirlpool Corp., Benton Harbor, MI. (Assignee).
J. W. Van Kirk.
United States Patent 4,053,404. Issued October 11, 1977. Official Gazette of the United States Patent Office, Vol. 963, No. 2, p 623, October, 1977. 1 fig.

Descriptors: *Oxidation, *Heat exchangers, *Patents, *Sewage treatment, *Energy, Incineration, Equipment, Heat treatment, Waste water treatment.

A continuous wet oxidation process has been patented for use with organic waste sewage. The process includes treatmet of the sewage in a reactor at 550-560F and pumping of the waste sewage through two heat exchangers. The treated liquid is passed from the reactor through the second heat exchanger, through a throttling device, and then through the first heat exchanger in the series. The pressure of the effluent upstream from the throttling device maintains the pressure in the second heat exchanger at about 1500-1600 psi and the temperature at about 560F. The pressure downstream from the throttling device and in the first heat exchanger is maintained at less than 500 psi and the temperature at no more than 400F. The influent waste sewage is thus preheated in two stages before entering the reactor. The first stage is carried out at a lower temperature and pressure in the first heat exchanger, and the second at a higher temperature and pressure in the second heat exchanger. (Schulz-FIRL)
W78-02664

METHOD AND SYSTEM FOR WASTE TREATMENT,
Grumman Aerospace Corp., Bethpage, NY. Research Dept. (Assignee).
L. A. Donnelly, L. C. Flocke, V. H. Himel, J. J. Mikals, and A. E. Munier.
United States Patent 4,053,399. Issued October 11, 1977. Official Gazette of the United States Patent Office, Vol. 963, No. 2, p 621-622, October, 1977. 1 fig.

Descriptors: *Separation techniques, *Disinfection, *Ozone, *Foam separation, *Incineration, *Patents, Sewage treatment, Screens, Centrifugation, Waste water treatment, Oxidation.

In a process which has been patented for treating raw sewage, the influent is first screened to separate out the solid materials. The screenings are then incinerated. The screened waste fluid passes through a centrifuge system for separation into sludge and clarified liquid. The sludge is incinerated and the clarified liquid passes to an ozone contact where ozone bubbles produce foam-entrapped solids, solids which adhere to ozone bubbles, and a disinfected liquid. The disinfected liquid is removed from the system and the foam-entrapped solids and bubble-held solids are incinerated. (Schulz-FIRL)
W78-02665

SCUM REMOVAL SYSTEM FOR A SEWAGE SETTLING TANK,
Sybron Corp., Rochester, NY. (Assignee).
R. F. McGivern.
United States Patent 4,054,520. Issued October 18, 1977. Official Gazette of the United States Patent Office, Vol. 963, No. 3, p 993-994, October, 1977. 1 fig.

Descriptors: *Scum, *Skimming, *Settling basins, *Sewage treatment, *Patents, Equipment, Separation techniques, Waste water treatment, Scum removal.

Details of a patent for a scum removal system for sewage settling basins are presented. The system includes a scum trough along the end wall of the basin, a floating beach, and a skimmer assembly. The floating beach extends along the full length of the scum trough and is connected to the trough by a hinge at the upper edge, so that part of the beach extends into the settling tank liquid. The beach has a raised area between the settling basin side and the hinge side to prevent flow into the scum trough. The skimmer assembly moves back and forth across the settling tank, pushing scum towards the trough, and can pivot to push the floating material over the beach into the trough. The depth and distance over which the skimmer assembly travels is adjustable. A modified system includes a time-delay mechanism which can delay the motion of the skimmer back and forth across the tank. (Schulz-FIRL)
W78-02666

ACTIVATED SEWAGE PLANT AND PROCESS,
Dravo Corp., Pittsburgh, PA. (Assignee).
D. F. Heaney.
United States Patent 4,051,039. Issued September 27, 1977. Official Gazette of the United States Patent Office, Vol. 962, No. 4, p 1725, September, 1977. 1 fig.

Descriptors: *Filters, *Filtration, *Porous media, *Activated sludge, *Effluents, *Patents, Particle size, Particle shape, Sands, Waste water treatment.

A filter design for use with settled activated sludge process effluent prior to chlorination has been patented. The filter has a perforated false bottom on which a filter bed of not less than 6 ft. is supported. A headspace at the top of the filter is provided for influent, unfiltered water. Gravel-like, rounded quartz particles ranging in size from 1-3 mm comprise the filter media. The particles should be reasonably well sorted, having an average size difference not greater than 1 mm. A valved discharge outlet is located below the fales bottom for removal of filtered water. When the filter is being backwashed, the value outlet is closed and air is forced into the space below the false bottom. The filter is equipped with an overflow weir for receipt of backwash water. (Schulz-FIRL)
W78-02667

APPARATUS FOR THE AEROBIC TREATMENT OF LIQUID WASTE,
Carter (Ralph B.) Co., Hackensack, NJ. (Assignee).
W. O. Boschen, A. V. Annichiarico, and A. L. Johnson.
United States Patent 4,051,035. Issued September 27, 1977. Official Gazette of the United States Patent Office, Vol. 962, No. 4, p 1724, September, 1977. 1 fig.

Descriptors: *Aerobic treatment, *Equipment, *Aeration, *Patents, *Design data, Mixing, Liquid wastes, Waste water treatment.

A system for the aerobic treatment of liquid wastes has been patented. The system includes a liquid basin which is equipped with an array of continuous gas distribution lines with orifices for the release of a gas such as air. A mixing-aerator device can be placed above any of the orifices to enhance mixing and aeration of the liquid waste and gas. The system is improved by the addition of a number of brackets to correspond and connect to the array of gas distribution lines. The mixer-aerator can be selectively attached to the brackets. At least two rigid legs extend between the mixer-aerator and the bracket and are equipped with a foot at the end of each leg. The foot is manually fastened to a receptor when the mixer-aerator is in place upon the selected bracket, and can be disengaged without dislodging the gas distribution line. (Schulz-FIRL)
W78-02668

METHOD OF TREATING SEWAGE SLUDGE,
NGK Insulators Ltd., Nagoya (Japan). (Assignee).
S. Hara, and T. Kato.
United States Patent 4,050,390. Issued September 27, 1977. Official Gazette of the United States Patent Office, Vol. 962, No. 4, p 1511, September, 1977. 1 fig.

Descriptors: *Drying, *Dewatering, Equipment, *Incineration, *Heat treatment, *Patents, Fuels, Gases, Sewage treatment, Sludge treatment, Waste water treatment, Multiple hearth furnaces, Pyrolysis, After-burner, Exhaust gases.

A method of sewage sludge dewatering in a multiple hearth furnace has been patented. The sludge is dried in the upper part of the multiple hearth furnace and reduced to ashes by pyrolysis in the lower portion of the furnace. Exhaust gases produced during both operations are collected independently. The exhaust gas produced during the drying state is dehumidified and then mixed with gas resulting from pyrolysis. Preheated gas is added to this mixture and the total mixture is burned in an after-burner. The combustion gas is discharged into the atmosphere and the heat generated in the after-burner is used to produce the preheated gas. (Schulz-FIRL)
W78-02669

PHOSPHATE REMOVAL FROM BOD-CONTAINING WASTEWATER,
Union Carbide Corp., New York. (Assignee).
L. C. Matsch, and R. F. Drnevich.
United States Patent 4,042,493. Issued August 16, 1977. Official Gazette of the United States Patent Office, Vol. 961, No. 3, p 1273, August, 1977.

Descriptors: *Patents, *Phosphates, *Nutrient removal, *Activated sludge, *Aeration, *Separation techniques, Effluents, Anaerobic conditions, Sludge treatment, Waste water treatment, Phosphate removal.

A method of phosphate removal from waste water during the activated sludge process has been patented. The phosphate-containing waste water is mixed with activated sludge and oxygen-containing gas in an aeration zone. While the fluid is circulated, microorganisms take up the phosphate and reduce the BOD content of the waste water. The phosphate-rich sludge is separated from the mixed liquor and passes through a phosphate stripping zone. Anaerobic conditions are maintained for part of the sludge, resulting in a phosphate-rich liquid and a phosphate-poor sludge fraction. The phosphate-rich liquid is removed and a portion of the sludge is recycled to the aeration zone. Phosphate stripping is enhanced by retaining sludge in the stripping zone for 2-10 hrs, introducing a stripping medium which has a low suspended solids and phosphate concentration, and maintain-

ing a flow rate through the stripping zone of 0.7-2.0 times the rate of removal of phosphate-enriched liquid. (Schulz-FIRL)
W78-02670

TREATMENT OF CYANIDE-CONTAINING SLUDGE BY FLUIDIZED BED INCINERATION SYSTEM (RYUDO SO SHOKYAKU SHISUTEMU NI YORU GANSHIAN SURAJI NO SHORI),
K. Kuwahara, and Y. Onishi.
Kankyo Sozo, Vol. 7, No. 8, p 41-44, 1977. 5 fig, 8 tab.

Descriptors: *Nitrogen compounds, *Incineration, *Sludge treatment, *Chemical precipitation, *Separation techniques, Heat treatment, Chemical reactions, Air pollution, Industrial wastes, Waste water treatment, *Cyanide, Fluidized bed incineration systems.

The removal of cyanide from sludge by complete thermal decomposition was tested using a fluidized bed incineration system made by the Japan Dryer Company. A description of the process is given with specifications of pilot incinerator and treatment procedures. The sample sludge containing 60,000 ppm of cyanide was treated using a sand fluidized bed at 400-540C. The total cyanide content was reduced to 26.0-78.1 ppm and that of the dissolved cyanide to 0.195-0.416 ppm. In the treatment of waste water containing a large amount of iron-cyanide complex, the waste water is treated by the Prussian blue method, precipitates produced are separated, and the filtrate containing less than 1 ppm of cyanide is disposed. The precipitate sludge is then treated by fluidized bed incineration. The cyanide concentration in the sludge after incineration was at undetectable levels, and that in the incinerator flue gas was 1.01-2.34 ppm. The sulfur oxides and nitrogen oxides concentrations in flue gas were also reduced by the incineration process. (Fujimoto-FIRL)
W78-02681

THE ELECTROLYTIC RECOVERY OF METALS FROM SLUDGES (SURAJI KARA NO KINZOKU NO DENKAI KAISHU),
Konan Univ., Kobe (Japan). Faculty of Science.
H. Nawafune, S. Mizumoto, and M. Kawasaki.
Kinzoku Hyomen Gijutsu, Vol. 28, No. 4, p 34-37, 1977.

Descriptors: *Heavy metals, *Electrodes, *Electrolysis, *Separation techniques, *Electrochemistry, Anodes, Cathodes, Equipment, Industrial wastes, Metals, Copper, Nickel, Zinc, Waste water treatment.

Laboratory experiments were used to investigate the recovery of metals such as nickel, copper, and zinc from metal processing sludges. The electrolytic system used for recovery included a cell which was divided into two compartments by a diaphragm. One of the compartments contained a cathode while the other compartment contained an insoluble anode. Heavy metals in the sludge were dissolved by acid liberated on the insoluble anode. The electrolytic cell was also equipped with a power source and a coulomb meter. The metal ion concentration and pH of the electrolyte could be maintained at specific values during electrolysis. The quantity of nickel transferred from the anolyte to the catholyte increased from 0 g at 30,000 coulombs to approximately 35 g at 180,000 coulombs. Copper transfer ranged from 0 g at 30,000 coulombs to approximately 20 g at 120,000 coulombs. The process results in recovery of metals which are suitable for reuse as anodes for electroplating. (Schulz-FIRL)
W78-02682

ON THE ORIGINAL LOAD OF THE PROCESS WATER DURING PAPER PRODUCTION BY DISSOLVED SUBSTANCES. PART I: INVENTORY OF STONE GROUNDWOOD PRODUCTION (UEBER DIE DURCH GELOESTE SUBSTANZEN VERURSACHTE BELASTUNG DES FABRIKATIONSWASSERS BEI DER PAPIERHERSTELLUNG. TEIL I: BESTANDSAUFNAHME BEI DER ERZEUGUNG VON STEINSCHLIFF),
Technische Hochschule, Darmstadt (West Germany). Inst. fuer Paperfabrikation.
For primary bibliographic entry see Field 5A.
W78-02683

5E. Ultimate Disposal Of Wastes

WASTEWATER TREATMENT AND REUSE BY THE SOIL-PLANT SYSTEM,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5D.
W78-02223

U.S. ARMY CORPS OF ENGINEERS CLEVELAND-AKRON THREE RIVERS WATERSHED, WASTEWATER MANAGEMENT SURVEY SCOPE STUDY.
Wright-McLaughlin Engineers, Denver, CO.
For primary bibliographic entry see Field 5G.
W78-02233

MOVEMENT OF PHOSPHOROUS FROM A SEPTIC SYSTEM DRAINFIELD,
Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 5B.
W78-02255

INPUT AND FATE OF PETROLEUM HYDROCARBONS ENTERING THE PROVIDENCE RIVER AND UPPER NARRAGANSETT BAY FROM WASTEWATER EFFLUENTS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 5B.
W78-02257

SEA BED INSTALLATION FOR SEWAGE PIPELINE.
Dock and Harbour Authority, Vol 58, No 680, p 134, July, 1977.

Descriptors: *Sewerage, *Sewers, *Outfalls, *Construction equipment, *Pipelines, Conveyance structures, Sewage treatment, Sewage disposal, Interceptor sewers, Waste water treatment, Sunderland(UK).

An underwater sewage pipeline is being constructed by the Engineering Division of John Laing Construction at Sunderland, Tyne and Wear, England. Commissioned by the Northumbrian Water Authority, the contract includes the supply and fabrication of 300 m of 1.4-m diameter pipe for the outfall site and a marine survey of the sewage outfall area. The pipe will be fabricated, welded into 120-m lengths, and coated with concrete at Hudson Dock. Pipe trenches will be dug by a grab-equipped crane which is mounted on a pontoon. Sections of pipe will be towed to the outfall site by a tug and the trench will be backfilled. The pipeline will lead to a concrete-coated diffuser in the Wear River. Untreated sewage will be screened and sludge removed at the Hendon Treatment Plant before disposal into the sea through the pipeline and outfall system. (Schulz-FIRL)
W78-02302

SEWERAGE OUTFALL PROTECTED.
For primary bibliographic entry see Field 8G.
W78-02303

FEEDSTUFF FROM SLUDGE WASTE.
German Patent DS 1937-580. Issued September 22, 1977. Derwent German Patents Abstracts, Vol. Y, No. 39, p 2, November, 1977.

Descriptors: *Sludge disposal, *Feeds, *Livestock, *Sewage treatment, *Patents, Waste water disposal, Heat treatment, Disinfection.

A process for preparing feedstuff from sewage sludge derived from mechanical, biological, or mechanical-biological breakdown processes has been patented. The sludge is preferably mixed with fresh or partially matured compost in a ratio of 10:1 to 1:2 based on dry weight. The mixture, which should have a moisture content of at least 25%, is then heated continuously or in batches at a temperature of 105-160C, preferably in the range 110-130C, for up to 5 min. The mixture should be heated for time period sufficient to insure sterility of the product. (Schulz-FIRL)
W78-02314

INVENTORY OF ENERGY USE IN WASTEWATER SLUDGE TREATMENT AND DISPOSAL,
J. E. Smith.
Industrial Water Engineering, Vol. 14, No. 4, p 20-26, July/August, 1977. 12 fig, 10 tab.

Descriptors: *Costs, *Energy, *Sludge treatment, *Sludge disposal, *Municipal wastes, *Construction costs, Operation and maintenance, Dewatering, Sewage treatment, Activated sludge, Incineration, Anaerobic digestion, Electric power demand, Fuels, Waste water treatment, Sludge treatment costs, Sludge disposal costs.

Costs of sludge treatment and disposal are dependent on a wide variety of factors, including method, location, climate, scale of operation, and effluent quality desired. Fuel use and energy requirements for various types of municipal waste water treatment and disposal are discussed. The distributions of capital, operating, and maintenance costs for a 30-mgd conventional activated sludge plant are presented. Costs for sludge handling processes, including thickening, stabilization, conditioning, dewatering, and incineration, are discussed and related to plant size. Electrical energy requirements for various phases of sewage treatment, including preliminary treatment, influent pumping, primary sedimentation, trickling filters, activated sludge processing, chlorination, sludge handling and disposal, and miscellaneous operating needs, are described and compared for different plant sizes. The utilization of anaerobic digester gas for power generation is examined. Sludge dewatering and disposal options are examined relative to construction costs, energy consumption and production, and sludge water content. (Schulz-FIRL)
W78-02320

THE OHIO FARM BUREAU'S APPROACH TO LAND APPLICATION OF SEWAGE SLUDGE,
N. M. Musselman.
Compost Science, Vol 18, No 4, p 24-25, July-August, 1977.

Descriptors: *Fertilizers, *Sludge disposal, *Agricultural practices, *Environmental effects, *Waste water disposal, Legal aspects, Return flow, Sewage disposal, Waste water treatment, Sewage sludge.

Opinions of the Ohio Farm Bureau Federation on practices involving the land application of sewage sludge as a means of sludge disposal and soil conditioning are presented. A particular incident in which a municipality of approximately 60,000 people sought to create a 1,000-acre sludge farm is discussed. Actions by the Ohio Farm Bureau were directing toward stopping the project in response to pressure applied by a suburb located between the city and the proposed sludge disposal site.

General ill feeling on the part of farmers and consumers toward land application of sewage sludge is a major stumbling block to this category of waste disposal. The Ohio Farm Bureau has not chosen to endorse the concept totally, in light of potential problems associated with sewage bacteria and pathogens, the question of liability should any incident occur, and objections by its constituents. (Schulz-FIRL)
W78-02327

RADIATION TREATMENT OF SLUDGE TO BE EXPLORED.
Water and Wastes Engineering, Vol. 14, No. 10, p 50, October, 1977.

Descriptors: *Disinfection, *Gamma rays, *Irradiation, *Fertilizers, *Food chain, Pilot plants, Cesium, Equipment, Sludge treatment, Sewage bacteria, Municipal wastes, Waste water treatment, Sludge irradiation.

The economic and scientific aspects of the use of gamma radiation for disinfection of dried or composted sludge will be investigated in pilot-scale studies at Sandia Laboratories in Albuquerque, New Mexico. Gough and Company, Ltd., of Staffordshire, England, have manufactured the 28,000-lb, 22-ft high irradiation system which is capable of handling several tons of dry sludge daily on a continuous basis. The irradiation facility consists of a conveyor system in which 30-60 lb of sludge is loaded into each of a series of rectangular 10 in x 12 in x 24 in buckets. The sludge-filled buckest are conveyed to a high radiation zone where they receive one megacurie of cesium-137 by passing over an d under a gamma radiatio source. The system is designed so that the conveyor spped can be adjusted to vary the radiation dosage and so that 20 buckets can occupy the irradiation zone at any given time. The system was developed to use cesium-137, a waste product of nuclear reactors, to disinfect sludge for use as a fertilizer or soil conditioner in the propagation of food crops. (Schulz-FIRL)
W78-02339

MUNICIPAL SLUDGE DISPOSAL ECONOMICS,
SRI International, Menlo Park, CA.
J. L. Jones, D. C. Bomberger, Jr, F. M. Lewis, and J. Jacknow.
Environmental Science and Technology, Vol. 11, No. 10, p 968-972, October, 1977. 1 fig, 4 tab.

Descriptors: *Cost comparisons, *Incineration, *Sludge treatment, *Sludge disposal, *Energy, Capital costs, Operation and maintenance, Dewatering, Waste water treatment, Waste water disposal.

Capital, operating, and energy costs are compared for five sludge handling alternatives. The options for treatment and disposal include: vacuum filtration of sludge to 20% solids, or filter press dewatering of sludge to 40% solids, prior to incineration; thermal conditioning, vacuum filtration, and incineration; high-pressure wet air oxidation, vacuum filtration, and landfill disposal; aerobic or anaerobic digestion prior to chemical conditioning and landfill disposal; and chemical conditioning, filter press dewatering, and flash drying to produce a dry fertilizer product for sale. Estimated costs for the five options are presented for waste water treatment plants having average dry weather flows of 10, 100, and 500 mgd at estimated base capital investment costs of $5, $27, and $100 million, respectively. Additional costs for the sludge handling options, electric power consumption, and gas or oil usage/production are presented. Cost comparisons indicated that there are variable economies of scale for the different sludge handling options, with aerobic digestion at the lowest capital cost for the 10-mgd plant and the two incineration options more attractive for the larger plants. Direct operating costs are compared with respect to energy costs; costs for chemicals, supplies, and replacement parts; operating and maintenance labor costs; and costs for landfilling of the sludge or ash. The incineration options have the lowest operating costs for plants with capacities of 10-500 mgd. Sensitivities of sludge handling costs are discussed with respect to changes in chemical usage, hauling costs, and energy credits. (Schulz-FIRL)
W78-02342

PUMP APPLICATIONS IN SEWAGE SLUDGE DEWATERING PROCESSES,
For primary bibliographic entry see Field 8C.
W78-02350

LIQUID WASTE EFFLUENT INSTALLATION UNVEILED IN FLA.
Water and Waste Engineering, Vol. 14, No. 9, p 133, September, 1977.

Descriptors: *Return flow, *Nutrient removal, *Sprinkler irrigation, *Waste water disposal, Treatment facilities, Forages, Fertilizers, Sewage treatment, Waste water treatment.

A center pivot irrigation system manufactured by Valmont Industries, Inc., is being used at waste water treatment facilities in Winter Haven, Florida, for spray irrigation of approximately 1500 acres of forage crops with municipal effluents. During treatment of the 5-mgd activated sludge plant, raw waste first passes through an aerated grit chamber for grit removal and odor control. It is then mixed with return activated sludge from the clarifiers and aerated. After aeration and clarification, the sludge is siphoned off the clarifier bottom for mixing with incoming raw waste water. The clarified effluent is chlorinated and pumped to a holding pond. Two aerobic digesters handle the excess sludge, which is then sent to a gravity thickener and centrifuge before disposal to farmland. The treatment process removes 95% of BOD and suspended solids in the raw waste water; remaining organics and nutrients are removed by spray irrigation. The 9 center pivots used to distribute the treated effluent are equipped with 7 drive units per system. The systems, which are electrically propelled, provide coverage for 70 acres each and are capable of distributing 450 gpm. The forage crops which are expected to remove approximaely 550 lbs N/acre/yr will receive approximately 475-500 lbs N/acre/yr from irrigation with waste water effluents. The effects of effluent application are monitored with 36 wells 10-30 ft deep located throughout the irrigation site. (Schulz-FIRL)
W78-02352

MAINE'S PERSPECTIVE ON COMPOSTING TOILETS AND ALTERNATE GREYWATER SYSTEMS,
Maine Dept. of Human Services, Augusta. Div. of Health Engineering.
E. Moreau.
Compost Science, Vol. 18, No. 4, p 18-19, July-August, 1977.

Descriptors: *Domestic wastes, *Septic tanks, *Waste water disposal, *Water reuse, *Water utilization, Equipment, Waste water treatment, *Maine, *Composting toilets, Greywater systems.

After review of extensive studies in Sweden and other countries, the state of Maine in 1974 became the first in the United States to authorize the installation of compost toilets. Although current technology does not favor the replacement of existing household toilet facilities with compost systems, experiences with more than 200 compost toilets installed in Maine have been favorable. An exhibition was held in Augusta, Maine, in 1975 for the introduction of various alternatives to conventional toilet systems. A greywater treatment system is required by the Maine State Plumbing Code when composting or waterless toilets are used in residences with running water under pressure. The system normally includes a septic tank and a soil disposal field, for treatment of greywater which can include grease, fats, food solids, and bacteria in a relatively undiluted form. The drainage field for a separated system is usually 200-1000 sq ft as compared to 300-400 sq ft with a combined system. Changes in Maine's exterior plumbing code to further encourage water conservation are expected. (Schulz-FIRL)
W78-02355

CITY REAPS INCOME FROM SLUDGE PROCESSING SYSTEM,
I. M. Knapp.
Public Works, Vol 108, No 10, p 103-105, 118, October, 1977.

Descriptors: *Fertilizers, *Sludge disposal, *Dewatering, *Nutrient removal, *Costs, *Sludge treatment, Flocculation, Drying, Municipal wastes, Treatment facilities, Sewage treatment, Waste water treatment.

A sludge processing system which would produce a product that could be sold as a soil conditioner/fertilizer has been chosen by the city of Largo, Florida, as a means of waste disposal. Additional cost estimates indicate that the $800,500 facility could be sold at $160-250/ton. The facility is designed to dry and package sludge resulting from the treatment of 9 mgd of municipal wastes. Industrial wastes are excluded from the sludge, eliminating any deleterious effects produced by heavy metals. Nutrients can be added automatically to meet requirements for different soil conditions. The plant is entirely automated and only requires one operator for startup. A digester clarifier increases the influent sludge solids content from 1% to 3%. The sludge is then pumped to a blender for flocculation with a polymer and combined with a portion of previously dried sludge. Filter belt presses further dewater the sludge to a cake form. The remaining water is evaporated in a rotary, three-pass drum dryer through which an air stream at 8 00-900 F passes. The dried sludge is then packaged in three-ply, plastic-lined bags. Actual total operating costs for a 6-month test period were $140/ton and packaged fertilizer was sold at $100-160/ton, depending on the quantity of sludge purchased. The addition of a prethickener/conditioner step to the process is expected to further reduce production costs. (Schulz-FIRL)
W78-02363

WOONSOCKET, RHODE ISLAND SEEKS SOLUTION TO ALUM SLUDGE DISPOSAL PROBLEM,
Metcalf and Eddy, Inc., Boston, MA.
J. Goss.
Journal of the New England Water Works Association, Vol 30, No 3, p 191-198, September, 1976. 4 fig.

Descriptors: *Water treatment, *Sludge treatment, *Sludge disposal, *Clarification, *Treatment facilities, Costs, Filtration, Suspended solids, Sewage treatment, Municipal wastes, Waste water treatment, Woonsocket(RI).

Metcalf and Eddy, Inc., of Boston, Massachusetts, was contracted by the city of Woonsocket, Rhode Island, to design a method of disposal for the alum sludge produced by the 11.25-mgd Woonsocket water treatment plant. Previously, settled sludge from the upflow clarifiers (4,600 mg/liter suspended solids) and spent water used to backwash the filters (170 mg/liter suspended solids) had been discharged directly to the Blackstone River. One of the problems encountered in design of a disposal method was that the wastes, in the form of a small volume of concentrated waste and a large volume of dilute waste, were produced intermittently and

for very short periods. The wastes also had markedly different settling characteristics. An equalization tank to hold the clarifier sludge flow and the settled sludge from a filter backwash water presettling basin was chosen to even out waste concentrations and flow. Variable physical and mechanical processes, including lagooning, sand bed drying, freezing, centrifugation, vacuum filtration, and pressure filtration, were evaluated with respect to producing a sludge cake with 20% or more solids suitable for land disposal. Climatological considerations, land requirements and other factors led to the choice of construction of facilities to discharge the sludge to Woonsocket's sewage treatment plant for treatment and disposal. A schematic diagram of the recommended $1.61-million alum sludge disposal facility is presented. (Schulz-FIRL)
W78-02372

SAMPLES OF RHINE WATER REVEAL ORGANIC CARBON CONTENT,
Karlsruhe Univ. (West Germany). Dept. of Water Chemistry.
For primary bibliographic entry see Field 5B.
W78-02383

OCCURRENCE AND DISTRIBUTION OF BACTERIAL INDICATORS AND PATHOGENS IN CANAL COMMUNITIES ALONG THE TEXAS COAST,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
For primary bibliographic entry see Field 5B.
W78-02391

RECLAIMED WATER FOR CAPE PENINSULA.
The Civil Engineer in South Africa, Vol. 19, No. 7, p 163-164, July, 1977.

Descriptors: *Water reuse, *Return flow, *Artificial recharge, *Hydrogeology, Saline water intrusion, Water resources development, Groundwater, Environmental effects, Waste water disposal.

Limited water resources in the Cape Peninsula region of South Africa have led to an investigation of the reclamation and reuse of treated sewage effluents by the Water Research Commission, the city of Cape Town, and the National Institute for Water Research of the CSIR. Extensive studies have been conducted on the use and hydraulic suitability of the sand beds of the Cape Flats for the storage, infiltration, and abstraction of natural water or purified effluents. Hydrogeologic studies indicated that approximately 75,000 cu m of water, or 3 cu m H2O/day/m of coastline, was being lost daily to False Bay by subterraneous flow. The interception of this water through 50 boreholes to be drilled along the coast has been recommended. Current research has focused on the possible effects of pollutants on this water supply and on operations of a 300-cu-m/day pilot plant at the Athlone Sewage Works. (Schulz-FIRL)
W78-02397

PRELIMINARY DESIGN OF WASTEWATER LAND APPLICATION SYSTEMS,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
D. A. Haith, A. Koenig, and D. P. Loucks.
Journal Water Pollution Control Federation, Vol. 49, No. 12, p 2371-2379, December 1977. 6 tab, 14 ref.

Descriptors: *Waste water(Pollution), *Economic efficiency, *Alternative planning, *Optimization, *Water pollution control, *Design, Nitrogen, Estimating, Simulation analysis, Equations, Mathematical models, Systems analysis, *Land disposal, Spray irrigation, Cost minimization, Storage ponds, Cost effectiveness.

Developed is a method to aid in the preliminary design and evaluation of alternative spray irrigation land application systems. A mathematical model based on monthly mass balance equations for water and nitrogen in a storage pond and the soil provides estimates of the costs of system components and the nitrogen concentration of water draining the spray irrigation site. The level of analysis corresponds to the second state of a cost-effectiveness study as defined in relevant U.S. Environmental Protection Agency guidelines. An earlier paper outlined a model appropriate for the preliminary planning stage. The relationships in the model presented herein are in the form of monthly inventory equation for water and nitrogen in the pond and soil. Cost equations for the various components of the land application system are presented for costs as of December 1976. The combination of the cost and mass balance equations results in a management model which would determine the least costly combination of storage pond size, irrigation rates, and irrigation site area. The model is highly nonlinear and cannot be solved exactly using mathematical programming methods, but the mass balance equations are readily incorporated into a simple procedure which can be used to evaluate the performance and costs of alternative preliminary designs. This procedure is applied to an example consisting of a wastewater flow from a hypothetical city of 50,000. (Bell-Cornell)
W78-02438

REGIONAL PLANNING FOR LAND APPLICATION OF WASTEWATER,
Pirnie (Malcolm), Inc., White Plains, NY.
C. H. Chiang.
Journal Water Pollution Control Federation, Vol. 49, No. 12, p 2366-2370, December 1977. 2 fig, 2 tab, 4 ref.

Descriptors: *Waste water(Pollution), *Alternative planning, *Economic efficiency, *Optimization, *Cost analysis, Regional analysis, Evaluation, Treatment facilities, Networks, Mathematical models, Equations, Systems analysis, *Algorithms, *Heuristic algorithm, *Land disposal, *Regional planning, Cost effectiveness, Cost minimization, Regional systems.

Described is a heuristic algorithm for regional wastewater planning problems where land application of wastewater is considered. The algorithm is concerned with which land sites should be developed to serve which treatment plants and with what capacity. By a series of straightforward marginal cost analyses, the algorithm implicitly evaluates most of the solutions to the problem while explicitly evaluation only a few to reach a final solution. The objective of the algorithm is to define a range of good or low-cost solutions close to the least-cost solution. To demonstrate its usefulness, the algorithm is applied to a simplified regional planning problem. In general, the major features of the algorithm include: easy use; flexible computation; and generation of a number of low-cost solutions at very low engineering and computer costs. Indeed, no more information is required than that needed for the preparation of traditional engineering practices. The algorithm provides engineers or planners with a ready tool for cost-effectiveness analysis to generate quickly a number of good, possibly least-cost solutions. (Bell-Cornell)
W78-02439

EFFECT OF WASTEWATER SLUDGE ON SOIL MOISTURE RELATIONSHIPS AND SURFACE,
Wisconsin Univ.-Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 5C.
W78-02454

EFFECTS OF ATHENS POLLUTION OUTFALLS ON MARINE FAUNA OF THE SARONIKOS GULF,
Durham Univ. (England). Dept. of Botany.
For primary bibliographic entry see Field 5C.
W78-02479

NUTRIENT-ALGAL RELATIONSHIPS IN LAKE LILLINONAH, DANBURY, CONNECTICUT, JUNE-SEPTEMBER, 1975.
National Enforcement Investigations Center, Denver, CO
For primary bibliographic entry see Field 5C.
W78-02488

THE REPORT TO CONGRESS: WASTE DISPOSAL PRACTICES AND THEIR EFFECTS ON GROUND WATER.
Environmental Protection Agency, Washington, DC. Office of Water Supply.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 081, Price codes: A23 in paper copy, A01 in microfiche. Report No. EPA-570/9-77-001, January, 1977. 512 p, 84 fig, 80 tab, 360 ref, 5 append.

Descriptors: *Groundwater, *Waste disposal, *Water pollution sources, *Water quality control, Water wells, Water supply, Aquifers, Industrial wastes, Impoundments, Lagoons, Landfills, Septic tanks, Cesspools, Municipal wastes, Waste treatment, Sludge, Brines, Mine wastes, Injection wells, Groundwater movement, Sewerage, Legislation, Administrative agencies, Feedlot wastes, Land spreading.

This report is an evaluation of the impact of waste disposal practices upon present and future underground sources of drinking water, a study carried out persuant to Section 144(a)(4) of the Safe Drinking Water Act. Waste disposal practices included in this study are those activities which result in the actual collection and disposal of liquid, semi-solid, and solid wastes. The first few sections of the report describe the use and occurrence of the ground water resource along with the mechanisms of contamination. These are followed by a discussion of each of the major waste disposal practices responsible for either localized or regional ground water pollution. The next section deals with the importance of non-waste disposal practices as they affect ground water quality. The final two sections define the present status of Federal legislation that applies to ground water protection and the various regulatory options and strategies available to state and local agencies. (Eberle-NWWA)
W78-02537

DEEP WELL INJECTION OF INDUSTRIAL WASTES: GOVERNMENT CONTROLS AND LEGAL CONSTRAINTS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 5G.
W78-02538

COMBINED BIOLOGICAL TREATMENT AND UNDERGROUND INJECTION OF REFINERY WASTE WATER,
Energy Research and Development Administration, Bartlesville, OK. Bartlesville Energy Research Center.
For primary bibliographic entry see Field 5D.
W78-02548

FEASIBILITY OF RETURNING FLY ASH TO WESTERN MARYLAND FOR MINE RECLAMATION.
Maryland Environmental Service, Annapolis.
For primary bibliographic entry see Field 5G.
W78-02620

PROCEEDINGS OF THE NINTH DREDGING SEMINAR.
Texas A and M Univ., College Station. Center for Dredging Studies.

For primary bibliographic entry see Field 5C.
W78-02646

WATER QUALITY MANAGEMENT--PROBLEM AREAS IN SEWERAGE AND SEWAGE DISPOSAL,
Thames Water Authority, London (England). Vales Div.
V. H. Lewin.
The Public Health Engineer, Vol. 5, No. 4, p 125-127, September, 1977.

Descriptors: *Water quality management(Applied), *Equipment, *Multi-purpose projects, *Planning, *Water pollution control, Municipal wastes, Industrial wastes, Water treatment, Waste water treatment.

Various topics are discussed in response to the newly organized tri-purpose regional water and waste treatment authorities in England. The need for more effective communications systems, telemetry, data acquisition, and information storage and retrieval systems is discussed. Specialized training and education programs are cited as important in assuring adequate water and waste water treatment by regional authorities. Sewer rehabilitation programs are suggested to relieve overloading of treatment plants produced by infiltration and inflow in deteriorated sewage systems. Adjustments in unit processes according to pollutant load is suggested. Various aspects of water quality planning and waste water management are discussed, including the development of long-term plans which are periodically reevaluated. The need for better maintenance and a greater understanding of the workings of mechanical and electrical equipment is described. (Schulz-FIRL)
W78-02663

METHOD OF TREATING SEWAGE SLUDGE,
NGK Insulators Ltd., Nagoya (Japan). (Assignee).
For primary bibliographic entry see Field 5D.
W78-02669

GROUND-WATER CONTAMINATION: PROBLEMS AND REMEDIAL ACTIONS,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 5B.
W78-02675

5F. Water Treatment and Quality Alteration

HIGH NITRATE DENTRIFICATION IN CONTINUOUS FLOW-STIRRED REACTORS,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5D.
W78-02217

HYDROGEN SULFIDE PROBLEMS,
National Water Well Association, Worthington, OH.
T. E. Gass.
Water Well Journal, Vol. 31, No. 12, p 26-7, December, 1977.

Descriptors: *Hydrogen sulfide, *Water treatment, Taste, Sulfur bacteria, Corrosion, Oxidation, Ozone, Sulfur, *Impaired water quality, Odor, Chlorination, Potassium compounds, *Activated carbon, *Filters, *Filtration, Potassium permanganate, Maganese-greensand filter.

Domestic water supplies containing more than 1.0 ppm of hydrogen sulfide taste and smell like rotten eggs and are extremely corrosive. H2S solubility increases as water temperature increases. It occurs near coal and oil fields, and where sulfate-reducing bacteria exist. H2S concentrations less than 1.0 ppm require only a one-cubic-foot, activated carbon filter. Greater concentrations require chemical oxidation and filtration. Chlorine oxidation requires a 20-minute contact time and a 0.5-10 ppm chlorine residual. Potassium permanganate needs less contact time and utilizes a manganese-greensand filter to remove solid sulfur particles. These filters require regular maintenance for effective performance. Although ozonation oxidizes H2S most effectively, its initial cost is high. This cost is competitive with other chemical treatments when amortized over several years. (Palmer-NWWA)
W78-02283

BASIC CONCEPTS IN DISINFECTION WITH OZONE,
Miami Univ., Coral Gables, FL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W78-02324

EFFECT OF SEWAGE TREATMENT BY STABILIZATION POND METHOD ON THE SURVIVAL OF INTESTINAL PARASITES,
King Inst. of Preventive Medicine, Gindy (India).
For primary bibliographic entry see Field 5D.
W78-02330

PROCESS ARRANGEMENTS FOR ION EXCHANGE AND ADSORPTION,
California Univ., Berkeley. Dept. of Chemical Engineering.
T. Vermuelen.
Chemical Engineering Progress, Vol 73, No 10, p 57-61, October, 1977. 7 fig, 5 ref.

Descriptors: *Ion exchange, *Separation techniques, *Membrane processes, *Adsorption, *Tertiary treatment, Filtration, Anion exchange, Cation exchange, Water treatment, Desalination, Operation and maintenance, Chemical wastes, Municipal wastes, Water reuse, Reverse osmosis, Waste water treatment.

The use of various resin types and process arrangements can maximize performance and minimize operating costs of ion exchange and adsorption in water and waste water treatment. The use of ion retardation materials, ion-exclusion agents, electron-exchange resins, and polymeric resin membranes to enhance ion exchange processes is discussed. Several process arrangements are described, including large-scale 'swimming-pool' systems for water treatment, mixed bed deionization, cyclic multi-bed systems, continuous ion exchange, reverse-flow regeneration, combination fixed-bed and fluidized-bed systems for water softening, and the Sirotherm or thermal-cycling process for desalination. Schematic flow diagrams are provided for each of the process configurations. (Schulz-FIRL)
W78-02331

UV-OX(TM) PROCESS FOR THE EFFECTIVE REMOVAL OF ORGANICS IN WASTEWATERS,
Westgate Research Corp., Marina del Rey, CA.
For primary bibliographic entry see Field 5D.
W78-02335

USE OF OZONE IN THE DISINFECTION OF COLIPHAGE T-7 VIRUS,
Abbott Labs., Crystal Lake, IL.
D. S. Hacker, and T. Lockowitz.
AIChE Symposium Series, Vol. 73, No. 166, p 242-251, 1977. 6 fig, 3 tab, 16 ref.

Descriptors: *Ozone, *Virus, *Disinfection, *Mass transfer, *Kinetics, Analytical techniques, Microorganisms, Mathematical models, Model studies, Sewage treatment, Water treatment, Waste water treatment, Virus deactivation, Ozone disinfection mechanisms.

Results of investigations on the deactivation kinetics of E. coli bacteriophage virus with gaseous ozone in a batch, semiflow, gas-liquid reactor are presented. Virus models which have been used to explain the observed rates of virus disinfection by chemical treatment are described. Descriptions of the experimental procedures, cultures used in the study, the three-layer agar technique used for plaque assays of the bacteriophage T-7 titer, and the sterility tests on primary effluent are presented. The survival percentage of virus with time is illustrated for isothermal and constant pH systems, and compared with the pseudo-first-order decay of virus. The studies indicated that virus deactivation was governed by two general rate processes: mass transfer in the saturation of the solution by the disinfectant; and the kinetic first-order deactivation rate of the virus. The viscosity and the presence of impurities in the media did not effect the reaction rate. A mathematical model to describe the trend observed in experimental reaction data for the initial phase of deactivation and the induction period is presented. (Schulz-FIRL)
W78-02343

REACTOR CLARIFIERS.
Effluent and Water Treatment Journal, Vol 17, No 8, p 427, August, 1977.

Descriptors: *Clarification, *Flocculation, Equipment, *Suspended solids, Design data, Suspended solids, Polyelectrolytes, Waste water treatment, Water treatment.

Flocculation and clarification have been widely used in the water and waste water treatment industries for removal of suspended solids, algae, and color. High rate solids-contact reactor clarifiers have been developed by Emico. The top diameter of a bell-shaped reactor for a 200-ft dia clarifier would be approximately 50 ft with a turbine diameter of 28 ft. Influent is fed horizontally through the tank side wall and reactor well wall into the recirculation cylinder. The unit combines flocculation, coagulation, clarification, and positive sludge removing capability in a single tank. The unit's other functions include removal of silica, suspended solids, BOD, and COD; precipitation; and lime-soda or brine softening. In handling raw water from rivers and wells, the high rate solids contacting unit is capable of reducing turbidity from 20 ppm to 1 ppm. Additional applications of the Emico units are described. (Schulz-FIRL)
W78-02360

POLIO-VIRUS ADSORPTION FROM WATER ONTO SILICATE MINERALS,
Maine Univ. at Orono. Dept. of Civil Engineering.
S. H. Lo, and O. J. Sproul.
Water Research, Vol 11, No 8, p 653-658, 1977. 6 tab, 19 ref.

Descriptors: *Adsorption, *Viruses, *Silicates, *Mineralogy, *Waste assimilative capacity, Microorganisms, Filtration, Geochemistry, Organic wastes, Soil properties, Separation techniques, Effluents, Waste water treatment, Water treatment.

Batch studies and column experiments were used to investigate virus adsorption on silicate minerals in natural water and treated domestic waste water under controlled conditions. In the first phase of the experiments, the degree of adsorption of poliovirus type I was examined with secondary effluent from the University Park Sewage Plant in Orono, Maine, and six silicate minerals: actinolite, enstatite, kyanite, microcline, olivine, and sillimanite. In batch experiments, virus removal ranged from 51% to 78% for the different silicate species, and only a minor part of the surface area of the granular particles was occupied by viruses. Actual adsorption capacities ranged from 642,000 to 895,000 PFU per mg of silicate mineral. When organic material was added to the system, virus

adsorption decreased to about 15-20% as a result of competitive adsorption. In the second series of experiments polio-virus movement through a microcline-filled column was investigated with biologically treated domestic waste water effluent applied at a rate of 0.61 cu m/day-sq m. With a natural water system, virus started to appear in the column effluent after 6 days and 99% removal was still being achieved after 13 days. With waste water, virus appeared in the column effluent after 1.33 days. The lower removal efficiency with waste water was attributed to competitive adsorption in the presence of organic materials. Comparisons of the adsorptive capacities of the individual silicate minerals revealed that olivine adsorbed more viruses per unit weight than the other mineral species. It was suggested that the degree of adsorption was greater for minerals with higher acidity. (Schulz-FIRL)
W78-02365

INFLUENCE OF TEMPERATURE AND U.V. LIGHT ON DISINFECTION WITH OZONE,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
S. Farooq, R. S. Engelbrecht, and E. S. K. Chian.
Water Research, Vol 11, No 8, p 737-741, 1977. 6 fig, 11 ref.

Descriptors: *Disinfection, *Ozone, *Sewage bacteria, *Ultraviolet radiation, *Mycobacterium, Aerobic bacteria, Activated sludge, Effluents, Acid bacteria, Microorganisms, Water pollution control, Sewage treatment, Waste water treatment, Water treatment.

Laboratory studies with the acid-fast bacteria, Mycobacterium fortuitum, were used to examine the effects of temperature and ultraviolet light on the degree of inactivation of microorganisms by ozone. De-ionized buffered water innoculated with test organisms was fed to a continuous flow-type reactor. The partial pressure of gaseous ozone was kept at 16.8 mg/liter with an ozone-air gas flow rate of 0.51/min. The effect of temperature on the survival of M. fortuitum was examined at a constant rate of applied ozone and at varying ozone residuals at 9, 20, 30, and 40C. Studies indicated that the degree of inactivation increased with the ozone residual and with temperature. The second series of experiments on the effect of temperature were conducted at constant ozone residuals maintained by varying the partial pressure of applied ozone. Results indicated that the disinfection efficiency increased significantly with temperature. A value of 18.3 Kcal was calculated from temperature data for the activation energy for ozone disinfection. The chemical reaction rate between ozone and bacterial cells was suggested as the rate-limiting step in ozone disinfection at pH 7.0. The effect of ultraviolet light on ozone disinfection was investigated with activated sludge effluent equilibrated with M. fortuitum. Studies indicated that although ultraviolet light did not enhance ozone efficiency, ultraviolet light alone did have significant disinfecting abilities. (Schulz-FIRL)
W78-02366

THE PROMISES OF ION EXCHANGE,
Shell Development Co., Houston, TX.
F. G. Helfferich.
Chemical Engineering Progress, Vol 73, No 10, p 53-55, October, 1977.

Descriptors: *Separation techniques, *Ion exchange, *Membrane processes, *Absorption, *Anion exchange, Desalination processes, Permselective membranes, Ion transport, Municipal wastes, Filtration, Industrial wastes, Waste water treatment, Water treatment.

The historical background and development of ion exchange technology are described. Prior to 1935, most of the interest in ion exchange was directed toward developing a theory to explain the process. From 1935 into the 1950s research was directed toward developing ion exchange materials, leading to the introduction of more stable styrene polymers and the strong base anion exchange resins. Around 1955 commercial ion exchange membranes were introduced and the separation technique of ligan exchange was developed. Developments led to practical applications of ion exchange technology with emphasis on water treatment. Theoretical studies examined alkali metal equilibria on strong acid ion exchangers. Current research emphasizes conservation of the environment, energy, and raw materials. The need for research into the use of ion exchange in situations where other physical phenomena such as adsorption, ionic association, neutralization, or complex formation complicate treatment processes is emphasized. (Schulz-FIRL)
W78-02371

INVESTIGATION OF MUTAGENIC EFFECTS OF PRODUCTS OF OZONATION REACTIONS IN WATER,
Environmental Protection Agency, Washington, DC. Office of Water Supply.
J. A. Cotruvo, V. F. Simmon, and R. J. Spanggord.
Annals of the New York Academy of Sciences, Vol. 298, p 124-140, 1977. 5 ref.

Descriptors: *Ozone, *Bioassay, *Disinfection, *Environmental effects, *Organic compounds, Chemical reactions, Municipal wastes, Oxidation, Chemical wastes, Waste water treatment, Humic acids, Aldrin, Aroclors, DDT, Urea, Aromatic compounds, Organic acids, Mutagenicity.

Potential hazards posed by chlorinated organic chemicals in waste water and drinking water after disinfection by chlorination have led to an evaluation of potential biological activitiy of products of ozonation, an alternate means of disinfection. Rapid in vitro microbiologic bioassays of 28 selected organic compounds subjected to high levels of ozone, as well as similar analyses on municipal secondary treated waste water which had been disinfected with various agents, were used to evaluate mutagenic activity in Saccharomyces cerevisiae D3, Salmonella, and a rat liver homogenate. Process conditions were more severe than those in conventional ozone treatment. Only seven of the 28 organic compounds tested showed any mutagenic activity, and in those cases the activity was not dose-related and usually resulted from prolonged ozone exposure. (Schulz-FIRL)
W78-02378

CONCRETE FORMING FOR WATER AND WASTE TREATMENT PLANTS.
For primary bibliographic entry see Field 8F.
W78-02395

OPTIMAL CAPACITY EXPANSION WITH OFF-DESIGN COSTS,
California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 3A.
W78-02450

ASTP CHEMICAL AND MICROBIOLOGICAL ANALYSIS OF POTABLE WATER,
National Aeronautics and Space Administration, Houston, TX. Lyndon B. Johnson Space Center.
For primary bibliographic entry see Field 5A.
W78-02621

5G. Water Quality Control

A MULTI-PARAMETER WATER QUALITY MANAGEMENT MODEL FOR RIVER BASINS,
Cornell Univ., Ithaca, NY. Center for Environmental Research.
R. J. Hughto, and D. P. Loucks.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 588, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, November 1977. 73 p, 8 fig, 8 tab, 25 ref, 4 append. OWRT A-070-NY(1), 14-34-0001-7067, 7068.

Descriptors: *Water quality, Management, *Linear programming, *Optimization, Dissolved oxygen, Algae, Biochemical oxygen demand, Finite element analysis, System analysis, Nutrients, *Model studies, River basins, *Simulation analysis.

The QUAL II multi-parameter water quality simulation model, developed by Water Resources Engineers, Inc., is modified to become part of a preliminary steady-state, multi-parameter water quality management model. Seven constituents of water quality are considered: algae, ammonia, nitrite, nitrate, phosphorus, BOD, and DO. The model formulation is in terms of coupled partial differential equations for the seven constituents. The nonlinear, partial differential equations are linearized by the quasilinearization technique. These equations are solved numerically by the Galerkin finite element method. The management model is used to determine the required wastewater treatment that will meet both effluent and stream quality standards and satisfy management objectives. The model is applied to a sample hypothetical river. In the example, the least cost combination of biochemical oxygen demand (BOD) treatment levels at point source locations along the river is determined subject to dissolved oxygen quality standards in the river. Results from both simulation and optimization problems are compared.
W78-02202

BIOLOGICAL AND WATER QUALITY EFFECTS OF WHOLE LAKE MIXING,
Oklahoma State Univ., Stillwater. School of Biological Sciences.
D. W. Toetz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 646, Price codes: A05 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Stillwater, Completion Report, (1977). 78 p, 13 fig, 35 tab, 6 ref. OWRT A-068 OKLA(1).

Descriptors: Lakes, Reservoirs, *Aeration, *Impaired water quality, Algae control, Algae, Fish food organisms, Water pollution control, *Productivity, *Oklahoma, *Mixing, *Destratification, *Arbuckle Lake(Okla), *Ham's Lake(Okla), Artificial destratification, *Principal component analysis.

An axial flow pump designed by James Garton offers a cost-effective solution to water quality problems. The goal of this research was to describe water quality and biological effects of the Garton pump. The pump advanced fall turnover by one month and reduced vertical thermal differences during the summer in Arbuckle Lake (950 ha.). There was no effect of mixing on the vertical distribution of reducing compounds, algal biomass or transparency. Ham's Lake (40 ha.) was destratified each summer during 1973-1976. Algal biomass and fish growth were unchanged. The Allen-Bartell-Koonce model demonstrated that algal community response to destratification occurred more than four days after the physicochemical environment was altered. The species composition did not settle into a new circular pattern until six weeks later. The effects of lake mixing on the biota were investigated using isolated columns of water. Community production (P) and respiration (R) declined in isolated columns of lake water and mixing reduced both still further, but the ratio P/R was unchanged. The effects of mixing on fish predation on zooplankton could not be demonstrated.
W78-02203

OPTIMAL LOCATION OF A POLLUTING PLANT ON A LINE UNDER UNCERTAINTY,
Bar Ilan Univ., Rama-Gan (Israel). Dept. of Economics.
J. Paroush, and C. S. Tapiero.
Journal of Regional Science, Vol 16, No 3, p. 365-374, 1976. 2 fig, 2 tab, 15 ref.

Descriptors: *Mathematical models, *Statistical models, *Stochastic processes, *Optimization, *Industrial plants, *Human population, Pollution, Sites, Pollution abatement, Distance, Industrial wastes, Distribution patterns, Location theory, Location analysis.

The probable impact of a polluting plant on a lineally-distributed human population is assessed and the necessary and sufficient conditions for optimum location are determined. Probable interaction effects of distance and the case of randomly-distributed populations are considered. The probable pollution impact is resolved by representing diffusion effects of pollution through a stochastic process leading to a hypothetical binomial model for the interaction effects of distance. Optimum location is determined by establishing conditions for the expected damage case as well as for the expected cost case when the population may or may not be distributed randomly on the line. Because of the central limit theorem and the signs of the derivatives of loss functions, the relatively simple results may be generalized to more complicated situations. To study comparative static effects of population movements on optimum location, a novel technique is suggested based on localized population shifts. This approach can be extended to the investigation of taxation and zoning problems. The essential contribution of this paper is to recognize the probabilistic effects of distance and diffusion on, and interaction of those elements with, population distribution, of primary importance to environmental economics. (Lynch-Wisconsin)
W78-02211

INTERACTION OF SOLUBLE PHOSPHATE WITH ALUMINUM HYDROXIDE IN LAKES,
Wisconsin Univ.-Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 5C.
W78-02222

U.S. ARMY CORPS OF ENGINEERS CLEVELAND-AKRON THREE RIVERS WATERSHED, WASTEWATER MANAGEMENT SURVEY SCOPE STUDY.
Wright-McLaughlin Engineers, Denver, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-036 902, Price codes: A09 in paper copy, A01 in microfiche. Formulation Final Report, March 1973. 199 p, 18 fig, 34 tab, 7 ref.

Descriptors: *Waste water treatment, *Planning, *Ohio, *Lake Erie, Evaluation, Sewage treatment, Water treatment, Water pollution, Water pollution control, Lakes, Rivers, Effluents, Industrial wastes, Industrial waters, Cities, Municipal wastes, Urban runoff, *Water Pollution Control Act.

This study was undertaken to identify and to recommend one or more regional wastewater management systems capable of achieving the water quality goal intended by the Water Pollution Control Act Amendments of 1972, commonly termed the 'Clean Water Bill.' The natural goal has been interpreted in a set of specific effluent criteria to be met by 1985. The present study showed the national goal and the proposed date of compliance to be a feasible objective for the Study Area with present waste-water treatment technology. The results of the Cleveland Area Survey Scope Study will help to define the various regional and national impacts of the Clean Water Bill. (Sims-ISWS)
W78-02233

SCANNER, ORIENTER HELP FIND CASING LEAKS,
For primary bibliographic entry see Field 8G.
W78-02287

WATER POLLUTION LAW: CONGRESS CONCEDES SOME 'MID-COURSE CORRECTIONS'.
For primary bibliographic entry see Field 6E.
W78-02292

DESIGNING RETENTION BASINS FOR SMALL LAND DEVELOPMENTS,
McElhanney Surveying and Engineering Ltd., Surrey (British Columbia).
H. G. Kelly.
Water and Sewage Works, Vol. 124, No. 10, p 78-80, October, 1977. 3 fig, 1 tab.

Descriptors: *Design criteria, *Mathematical models, *Storm water, *Retention, *Model studies, Rainfall-runoff relationships, Rational formula, Storm runoff, Urban drainage, Storm water retention basins.

An expanded model to provide design criteria for estimation of retention basin volumes for small land development projects has been reviewed. The time of concentration in the developed catchment basin and the attenuation of runoff intensity with time following the instantaneous peak rate of catchment basin discharge are incorporated. The model is recommended for use where analysis with synthetic hydrographs is not practical and where controlled rates of discharge are required. Intensity, duration, and frequency rainfall curves may be linearized in natural or logarithmic form. An equation for the outflow volume to the condition peak storage in the retention basin is derived. Equations for the volume of inflow during the period of increasing storage and for the volume of storage are presented. The model is used in the calculation of a design for a cul-de-sac in a 7.7-acre development intended for single family occupancy. (Schulz-FIRL)
W78-02299

SEWAGE COLLECTION SYSTEM RELIEVES THREAT TO FLORIDA OYSTER INDUSTRY.
Water and Sewage Works, Vol 124, No 8, p 64-65, August, 1977.

Descriptors: *Sewerage, *Sanitary engineering, *Plastics, *Sewers, *Pipes, Pipelines, Plastic pipes, Clay pipes, Hydraulic transportation, Municipal wastes, Sewage treatment, Florida, Water pollution control, Flood protection, Valves, Construction equipment, Waste water treatment, Vacuum sewage collection systems.

An AIRVAC vacuum sewage collection system was installed at Eastpoint, Florida, to relieve pollution of Apalachicola Bay and eliminate environmental hazards to the area's oyster industry. Cost estimates for the vacuum system were $375,000 or 42% less than for an equivalent gravity line collection system, because of the area's low topography and water table. Because Eastpoint is in a flood-prone area, valves will operate totally submerged with above-ground venting. Also, several pits were installed above grade to prevent valve flooding. Additional cost savings were realized by shallower trenching, the use of small-diameter PVC pipe instead of large-diameter clay pipe, and the omission of a series of expensive pumping stations. Three-inch PVC lines brought to grade and enclosed in water boxes have replaced standard sewer manholes. Field experience has indicated that valves should require minimal maintenance and should last for 50 yrs with little or no repair. Two collection stations, 15 miles of PVC vacuum lines, and 456 individual hookups comprise the system which will handle 165,000 gpd of municipal waste. (Schulz-FIRL)
W78-02301

CAN THIS SEWER PROJECT HAVE RECREATIONAL BENEFITS,
Board of Water and Sewer Commission, Northborough, MA.
J. Tracy, and C. Simmons.
Public Works, Vol 108, No 10, p 96-98, October, 1977.

Descriptors: *Sewerage, *Multi-purpose projects, *Recreation facilities, *Interceptor sewers, *Sewers, Construction, Paging, Conveyance structures, Rivers, Waste water treatment, Northborough(MA).

A sewer construction project for 5 miles of interceptor sewers 15-30 inches in diameter was designed by Camp, Dresser and McKee, Inc., of Boston for the town of Northborough, Massachusetts. Preliminary studies were conducted to determine whether any recreational benefits could be derived from the project for the Assabet River through reclamation of disturbed lands. The study concluded that the installation of an interceptor system could be coordinated with the construction of a recreational trail system. Studies on the physical feasibility of such a system indicated that the pipeline could be located within the undeveloped river margins without incurring high land acquisition costs or displacing residents and businesses. Specific design recommendations for the proposed trail system included a 250-ft separation between the trail and any dwellings, continuation of the trail on sidewalks and streets in densely populated areas, a large number of trail access points, prohibition of recreational vehicles on the trail, and possible connection with the Wachusett aqueduct right-of-way. (Schulz-FIRL)
W78-02304

SEWERS VERSUS SEWERLESS METHODS--A REPORT BY A CONGRESSIONAL COMMITTEE,
H. H. Leich.
Compost Sciences, Vol. 18, No. 4, p 26, August, 1977.

Descriptors: *Sewers, *Sewage effluents, *Sanitary engineering, *Water utilization, *Sewerage, Domestic wastes, Waste water treatment.

The advantage and disadvantages of centralized waste water treatment and home disposal systems were evaluated in a congressional report by the Subcommittee on the Environment and the Atmosphere, a division of the House Committee on Science and Technology. Conservative attitudes in sanitary engineering are cited as a stumbling block in the use of innovative technology in municipal waste water treatment. The need for consideration and development of viable alternatives to costly sewage treatment facilities which require a great deal of land is discussed. Self-contained household waste water treatment and disposal systems have been suggested as reasonable alternatives to regional collection and treatment systems. Current trends, however, are against the continuing use of septic tanks and the acceptance of sewerless toilet systems. Studies which define current individual and small unit technology, as well as costs, are recommended. (Schulz-FIRL)
W78-02312

EPA RELAXES ITS STANDARDS ON SEWAGE SETTLING PONDS.
Engineering News-Record, Vol. 199, No. 16, p 15, October, 1977.

Descriptors: *Oxidation lagoons, *Sewage lagoons, *Federal Water Pollution Control Act, *Suspended solids, *Biochemical oxygen demand, Water quality standards, Municipal wastes, Sewage treatment, Waste water treatment.

Since compliance with secondary waste water treatment standards set by the 1972 Federal Water

Pollution Act may require small communities to build elaborate sewage treatment plants and abandon existing settling ponds, the EPA has modified its effluent quality standards. Under the new regulations, communities which meet the BOD standard of 30 ppm over a 30-day average will not be required to comply with the equally strict standard for suspended solids. The relaxed standards will be adjusted to accomodate variations in climate and geography. Lagoon treatment of sewage or decomposition in an artificial pond exposed to air and sunlight is considered by the EPA as a viable alternative to more expensive means of secondary treatment. (Schulz-FIRL)
W78-02333

SOLID-LIQUID SEPARATION: AN OVERVIEW,
Houston Univ., TX. Dept. of Chemical-Petroleum Engineering.
F. M. Tiller, and J. R. Crump.
Chemical Engineering Progress, Vol. 73, No. 10, p 65-75, October, 1977. 14 fig, 2 tab, 15 ref.

Descriptors: *Separation techniques, *Filtration, *Mathematical models, *Dewatering, Equipment, Centrifugation, Clarification, Flocculation, Porous media, Flow measurement, Darcy's Law, Equations, Pumping, Chemical precipitation, Municipal waste, Industrial wastes, Water treatment, Waste water treatment.

Solid-liquid separation techniques have been used in a wide variety of situations, including mining, waste, and water treatment operations. Solids separation involves pretreatment to increase particle size, thickening, clarification, filtration, centrifugation, and post-treatment to remove soluble materials and reduce average porosity. Product specifications in terms of filtrate clarity, permissible solubles content of the cake, and average porosity or liquor content of the cake are discussed as criteria for equipment selection. Pretreatment methods used in solid-liquid separation include chemical pretreatment to enhance flocculation or coagulation; pH control; surface charge neutralization; and physical pretreatment with filter aids such as diatomaceous earth, fly ash, expanded perlite, and other filter aids. Filtration theory related to the flow within the cake and the external conditions imposed upon the cake by pumping and by filter design are discussed. Porosity variation and flow resistance are examined with respect to filtration mechanisms. Mathematical equations for the calculation of resistances and the definition of flow through porous media are presented. Material-balance and rate equations are derived for filtration at constant pressure and rate and at variable pressure and rate. Various techniques for cake washing are described. (Schulz-FIRL)
W78-02334

AREAWIDE WASTEWATER MANAGEMENT FOR METROPOLITAN DES MOINES,
Kirkham Michael and Associates, Omaha, NE.
C. L. Weber.
Public Works, Vol. 108, No. 10, p 72-74, October, 1977. 1 fig, 1 tab.

Descriptors: *Water management(Applied), *Planning, *Surveys, *Regional economics, Waste water treatment, Sewerage, Water pollution control, Municipal wastes, Waste water treatment, Water quality standards.

The Des Moines Areawide Waste Treatment Management Planning Program was created in response to water quality standards imposed by Public Law 92-500 and by the Iowa Water Quality Commission. An embargo placed on all new sanitary connections within the Des Moines area was later suspended for 90 days, to allow the 23 local governments to develop a framework in which to meet sewer planning agreements. The Central Iowa Regional Association of Local Governments (CIRAIG) in conjuction with state, local, and federal agencies set goals for the program: to protect surface and groundwater quality; to implement and carry out an areawide waste treatment planning program; to examine current population trends in the area; to construct new and rehabilitate existing waste water and drainage facilities; and to examine costs and land use requirements. Specific problems addressed by the planning program were the alleviation of combined sewer overflows and basement backups during wet weather, and the resolution of problems associated with assessment of sewage treatment charges to participating municipalities. The technical plant recommended for a population of 400,000 included individual waste water collection systems for 13 communities in the planning and the construction of a regional treatment facility adjacent to the existing Des Moines main treatment plant. The regional treatment plant has a design capacity of 50 mgd and includes several large equalization basins to store sanitary flows during periods of heavy rainfall. (Schulz-FIRL)
W78-02351

DYNAMO 1: A COST EFFECTIVE SOLUTION TO TREATMENT PROBLEMS,
Weston Environmental Consultants-Designers, Richmond, VA.
K. E. Patterson.
Water and Wastes Engineering, Vol 14, No 9, p 121-124, 126, September, 1977. 4 fig, 2 tab.

Descriptors: *Cost comparisons, *Water quality standards, *Model studies, *Mathematical studies, Analytical techniques, Computer models, Cost-benefit analysis, Energy, Municipal wastes, Treatment facilities, Sewage treatment, Waste water treatment.

DYNAMO-1, a first-generation dynamic computer programming model, was developed to evaluate and select the optimum waste water treatment alternative for a given raw waste load and effluent quality requirements from a series of 3,000 treatment alternatives. A multi-stage decision system which incorporates five factors per stage is used to find the maximum/minimum return configurations. Each stage examines the input state, output state, a decision variable, a stage return, and a stage transformation. Decision-making is based on a 'backwards' approach to find the optimal policy for each stage of a given state. A design/cost algorithm was developed to select the most cost-effective alternative from the range of possibilities. Since the program was designed to begin at the last step in the treatment process and end with a treatment stage representing raw waste entering the plant, the choice of treatment scheme is based on the raw waste load which the alternative is designed to handle and on the most cost-effective solution. A summary of alternatives considered by DYNAMO-1 in the analysis of designs is presented for a 10-mgd municipal waste water treatment plant on the basis of raw waste characteristics of BOD at 220 mg/liter and TSS at 150 mg/liter and effluent requirements of 20 mg/liter for both constituents. (Schulz-FIRL)
W78-02389

DOES POLLUTION ABATEMENT IMPROVE AQUATIC LIFE,
Normandeau Associates, Bedford, NH.
For primary bibliographic entry see Field 5B.
W78-02390

SURVEY FORECASTS FLOOD IN 1978 SEWERAGE MARKET.
Engineering News-Record, Vol. 199, No. 14, p 40-41, October, 1977. 1 tab.

Descriptors: *Costs, *Construction costs, *Planning, *Regional economics, *Sewerage, Financing, Forecasting, Municipal wastes, Waste water treatment.

A survey of 66 major sanitary districts in the United States indicated that they intended to spend approximately $2 billion for sewer and waste water treatment projects in 1978, with half of the funds slated for new, upgraded, or expanded treatment plants. Much of the support of these projects will be provided by the EPA's sewerage construction grants program. Estimates by the 66 districts of expenditures during fiscal 1979 totalled $1.1 billion, 40% less than the anticipated 1978 expenditures. The districts also reported an increase in the number of bidders per project in fiscal 1977 and the receipt of contract bids which averaged 12% below the engineer's projected cost. (Schulz-FIRL)
W78-02393

RISING SEWAGE PLANT OPERATION COSTS BEG ENGINEERED SOLUTIONS.
Engineering News-Record, Vol. 199, No. 14, p 71, October, 1977.

Descriptors: *Costs, *Sewage treatment, *Operation and maintenance, *Energy, Cost analysis, Capital costs, Planning, Waste water treatment.

Through analyses of current trends in sewage treatment costs, the EPA has predicted annual sewage treatment expenditures in the United States of $148.4 billion by 1990. The Water Pollution Control Federation's estimates are even higher at $150 million for operating costs and $450 billion for construction of municipal and industrial facilities. Current high costs for operation and maintenance as well as for energy, chemicals, and labor have indicated the need for engineered improvements in sewage plants' operating efficiency with particular emphasis on reducing costs. A survey revealed that in 38 sewage treatment plants annual operating and maintenance costs exceed amortized capital costs at 21 of the plants, and that in 18 secondary plants cumulative operation and maintenance costs exceeded their design and construction costs in less than 4 yrs. For primary plants costs for operation and maintenance exceeded costs for initial design and construction after an average of 13.4 yrs, and for all the plants in the survey after an average of 6.1 yrs. (Schulz-FIRL)
W78-02394

ADVANCED SEWAGE TREATMENT PLANTS, AN EPA PLANNING FLOP.
Engineering News-Record, Vol. 199, No. 19, p 12-13, November, 1977.

Descriptors: *Costs, *Treatment facilities, *Planning, *Tertiary treatment, Legislation, Waste water treatment.

A study by the General Accounting Office (GAO) that challenged the EPA's funding of advanced municipal waste water treatment plants and the corresponding reply by the EPA are discussed. A study of Vertex Corporation of McLean, Virginia, for EPA called for a temporary moratorium on federal funding for advanced plants, thereby agreeing with the GAO's recommendations. Current estimates suggest that approximately $21 billion in federal funds will be required to construct tertiary treatment plants for the estimated 1990 United States population. Fundamental defects in advanced waste water treatment policy cited by Vertex included the lack of planning based on technical information rather than on water quality standards, mathematical models, and wasteload allocations; and the apparent funding inequities among the states. The Vertex report also recommended the acquisition of more information on hydrodynamics, waste water discharges, water quality, sediments, and aquatic biology, along with an extensive cost-benefit analysis of advanced wastewater treatment. Review of areas of the 1972 Federal Water Pollution Control Act amendments which concern advanced waste water treatment is suggested. (Schulz-FIRL)

W78-02396

RECLAIMED WATER FOR CAPE PENINSULA.
For primary bibliographic entry see Field 5E.
W78-02397

HYDRAULIC MODELING OF THE RESERVOIR, LOCAL DESTRATIFICATION PHENOMENON,
Oklahoma State Univ., Stillwater. School of Mechanical and Aerospace Engineering.
D. K. McLaughlin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 778, Price codes: A02 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Stillwater, Completion Report, (1977). 13 p, 5 fig, 6 ref. OWRT A-070-OKLA(1), 14-34-0001-7076.

Descriptors: *Stratified lakes, *Hydraulic modeling, *Local destratification, *Plume penetration, *Water quality enhancement, Pumps, Conductivity measurements, Flow fisualization, Global destratification, Pumping, Mississippi, Garton propeller pump, Lake Okatibbee(Miss).

A new hydraulic model facility has been designed and constructed in which to study the hydrodynamics of local destratification of reservoirs. Experiments have been performed using a model of the Garton type of propeller used to destratify a reservoir (Lake Okatibbee, Mississippi) in the near vicinity of the release structure. The results of the experiments demonstrated the feasibility of modeling the local destratification of reservoirs using the Richardson number as the basic modeling parameter.
W78-02403

HYDROLOGIC CONSIDERATIONS ASSOCIATED WITH DREDGING SPRING PONDS IN WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 4D.
W78-02421

INTERNALIZATION IN A STOCHASTIC POLLUTION MODEL,
Tel-Aviv Univ., (Israel). Dept. of Economics.
E. Hochman, D. Zilberman, and R. Just.
Water Resources Research, Vol. 13, No. 6, p 877-881, December 1977. 6 fig, 10 ref.

Descriptors: *Water pollution control, *Stochastic processes, *Model studies, *Dairy industry, *Probability, *Economics, Investment, Methodology, Effluents, Runoff, Optimization, Shellfish farming, Standards, Water policy, Regional analysis, Equations, Systems analysis, Profit maximization, San Francisco Bay(Cal).

A stochastic model has been developed for internalizing pollution externalities. Pollution occurs or does not, depending on factors related to a stochastic environment and human error. But the probability of pollution can be altered by adopting various technologies. The model is described in detail in terms of industries located within a river basin, wherein the objective function is that of profit maximization. The model is applied to the problem of effluent runoff from dairies near the San Francisco Bay, which can prevent shellfish harvest in the bay. With runoff holding areas, pollution occurs if a rainstorm is severe enough to cause overflow. Standards rather than taxes are used as policy instruments in the model. Results generally indicate that an accurate approximation of stochastic distribution is a necessity. Specific implications for the dairy problem are that present regulations are too lenient. The methodology presented may be of critical importance for examining other problems, such as oil spills and nuclear power plant explosions. (Bell-Cornell)
W78-02440

STATISTICAL MODELS OF RIVER LOADINGS OF NITROGEN AND PHOSPHORUS IN THE LOUGH NEAGH SYSTEM,
Northern Ireland Dept. of Agriculture, Antrim. Freshwater Biological Investigation Unit.
For primary bibliographic entry see Field 5B.
W78-02441

A MODELLING METHOD FOR EVALUATING WATER QUALITY POLICIES IN NONSERIAL RIVER SYSTEMS,
Calgary Univ., (Alberta). Faculty of Business.
M. B. Bayer.
Water Resources Bulletin, Vol. 13, No. 6, p 1141-1151, December 1977. 5 tab, 14 ref.

Descriptors: *Water quality, *Pollution abatement, *Water policy, *River systems, *Efficiencies, *Thermal pollution, Evaluation, Methodology, Optimization, Dissolved oxygen, Biochemical oxygen demand, Temperature, Constraints, Waste water treatment, Treatment facilities, Standards, Mathematical models, Equations, Systems analysis, *Nonlinear programming, Temperature decay.

Described is a mathematical method which simplifies the evaluation of water quality policies for nonserial (branching) river systems. The method introduces dummy facilities at the junctions of the major tributary branches with the mainstream as replacements for the facilities and activities on the tributaries. The cost functions for the dummy facilities and the DO and BOD concentrations at the junctions as determined for each tributary are introduced into the mainstream serial system model which is then solved for the optimal values of the mainstream treatment plant efficiencies, the dummy facility effeciencies, and the tributary system DO and BOD concentrations using nonlinear programming. Given the optimum values for the dummy facility efficiencies and the values for the tributary system DO and BOD concentrations, the optimum values for the tributary treatment plant efficiencies are found using nonlinear programming. The method is applied to a river system with a mainstream and one major tributary which contain industrial and municipal organic and thermal polluters and their associated wastewater treatment plants. The objective function combines thermal pollution and cost minimization. (Bell-Cornell)
W78-02442

SENSITIVITY ANALYSIS OF STREETER-PHELPS MODELS,
Consiglio Nazionale delle Ricerche, Milan (Italy). Centro di Teoria dei Sistemi.
For primary bibliographic entry see Field 5B.
W78-02444

EFFECTS OF ACID MINE WASTES ON AQUATIC ECOSYSTEMS,
Southern Illinois Univ. at Carbondale. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W78-02456

RECOVERY OF AQUATIC BACTERIAL POPULATIONS IN A STREAM AFTER CESSATION OF CHEMICAL POLLUTION,
Texas Univ. Health Science Center, Houston. School of Public Health.
D. S. Cherry, R. K. Guthrie, F. L. Singleton, and R. S. Harvey.
Water, Air and Soil Pollution, Vol. 7, No. 1, p 95-101, 1977. 2 fig, 1 tab, 6 ref.

Descriptors: *Bacteria, *Water pollution, *Chemical wastes, *Stream improvement, *Streams, Pollutants, Aquatic bacteria, *South Carolina, Effluents, Water pollution effects, Tims Branch(SC), *Chromogenic bacteria, Savannah River Project(SC).

Tims Branch, on the Savannah River Project in Aiken, SC, a small stream which for about ten years received 229,900 kg/yr of waste chemicals in the effluent from a chemical production site, was evaluated for recovery of its bacterial population after the chemical discharges were stopped early in 1973. The stream, which flowed at a rate of 2,200 l/min, carried the effluent for about 10 km before emptying into the pollution-free Upper Three Runs Creek, with a flow rate of 370,000 l/min. Upper Three Runs was sampled as a non-polluted control stream. Chemical pollution seriously affected only the percentage of chromogen bacteria, and did not significantly alter the total colony-forming units nor the diversity as measured by colony types. At no time during the study were there significant differences between the counts of culturable bacteria in the two streams. In Tims Branch, chromogens increased from 15% of the bacterial populaton while polluted, to 25% one year after the discharges were halted. In the control stream, the figure was 28% during the study. Diversity in both systems was more affected by seasonal temperatures than the presence of chemical pollution. Mean total counts dropped from 187,000 in the polluted stream to approximate those of the control stream (170,000) after pollution stopped. No genus was consistently isolated from one stream and not the other; most common, in decreasing frequency, were: Bacillus sp., Flavobacterium sp., and Brevibacterium sp. (Lynch-Wisconsin)
W78-02477

CONTROLLING AQUATIC WEEDS,
New York Sea Grant Advisory Service, Albany.
M. Duttweiler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 370, Price codes: A02 in paper copy, A01 in microfiche. Marine Trader Flyer, No. 7, Excepted from a speech given at the St. Lawrence River Regional Marina Conference, December, 1975. 2 p. NYSS-GI-AS-75-002.

Descriptors: *Aquatic weed control, *New York, *Eutrophication, Nutrients, Harvesting, Water pollution, Water pollution control, Chemcontrol, Mechanical control, Mulching, Foods, Fertilizers, Beneficial use.

An increasing awareness of aquatic weed control problems in New York State has resulted in: (1) surveys of the extent of the problem, including in the Finger Lakes, St. Lawrence River, and Lake Ontario; (2) legislative action, principally through hearings and cooperation with citizen's groups; and (3) direct appropriations by the state legislature for aquatic weed control, for example $50,000 to treat weeds in Oneida Lake. Under New York State law, special assessment districts for water quality maintenance can be set up; such a district was formed under impetus of a Fair Haven Bay landowner's group. Control efforts are at present focussed on chemical treatment and harvesting. Because of inadequate information regarding the effects of chemicals, few can currently be applied. Harvesting is very expensive, and, like chemical control, must be repeated indefinitely. Some possible uses of harvested weeds include as a pulp base, in the paper industry cattle and sheep fodder, mulch, and fertilizer. The only long-term control measure is prevention of nutrient and sediment pollution in the water. (Lynch-Wisconsin)
W78-02500

LABORATORY TRIALS OF A NEW TRIAZINE HERBICIDE (DPX 3674) ON VARIOUS AQUATIC SPECIES OF MACROPHYTES ALGAE,
Agricultural Research Council, Kidlington (England). Weed Research Organization.
M. C. Fowler.
Weed Research, Vol. 17, No. 3, p 191-195, June 1977. 1 tab, 3 ref.

Descriptors: *Triazine herbicide, *DPX 3674, Myriophyllum verticillatum, Potamogeton pectinatus, Vaucheria dichotoma, Rhizoclonium hieroglyphicum, Cladophora glomerata, *Aquatic weed control, *Herbicides, *Laboratory tests, *Environmental effects, Chemcontrol, Triazine pesticides, Dissolved oxygen.

A new triazine herbicide, DPX 3674, was tested for effectiveness against aquatic weeds. The compound is formulated as either a 90% soluble powder or a 10% granule. It controls many terrestrial broadleaved weeds, grasses and a number of shrub and tree species and has low toxicity to fish and birds. Species used in the experiments were Myriophyllum verticullatum, Potamogeton pectinatus, Vaucheria dishotoma, Rhizoclanium hieroglyphicum and Cladophora glomerate. DPX 3674 was effective against all the species. A 1.0 ppm concentration was sufficient to kill Myriaphyllum verticillatum, Potamogeton pectinatus and Vaucheria dichotoma. Cladophora glomerata and Rhizoclonium hieroglyphicum were susceptible at 0.5 ppm. Compared to proven triazines terbutryne and cyanatryn, DPX 3674 is less active, requiring up to ten times the dosage to control these plants. A rapid decline of dissolved oxygen in the water, showing an inhibition of photosynthesis, is typical of triazines. The herbicide might be a useful growth regulatory chemical in situations where a complete kill is not wanted. Continued field testing under natural conditions is recommended. (Coyle-Wisconsin)
W78-02516

A SOCIAL AND ECONOMIC IMPACT STUDY OF OFFSHORE PETROLEUM AND NATURAL GAS DEVELOPMENT IN ALASKA. PHASE II.
Mathematical Sciences Northwest, Inc., Bellevue, WA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 706, Price codes: A13 in paper copy, A01 in microfiche. Report No. BLM-SE-77-02 to Bureau of Land Management, Washington, D.C., October 15, 1976, 369 p, 9 fig, 121 tab, 4 maps, 57 ref. MSNW/AC-76-2074, 08550-CT5-46.

Descriptors: *Alaska, *Oil, *Natural gas, *Economic impact, *Forecasting, Economics, Social aspects, Offshore platforms, Baseline studies, Model studies, Future planning(Projected), Analytical techniques, Social impact, Regression analysis, Yakutat(AK), Dillingham(AK), Naknet(AK), Kotzebue(AK), Input-output modelling.

Impact models developed in Phase I of this study using the experience of hydrocarbon exploitation in the Kenai-Cook Inlet region of Alaska are applied to future exploitation of potential offshore petroleum and natural gas resources in Yakutat, Dillingham-Naknet, and Kotzebue, Alaska. I/0 modelling was considered the best available technique; a regression model devised during Phase I which successfully estimated historical impacts in the Kenai region proved inapplicable in Phase II. A major difference between the Kenai region and the Phase II communities is that the former is linked to Anchorage in terms of geography, communication, and transportation, while the latter are logistically related more to the lower 48 states. For the communities studied, demography, labor force, employment, income level, community facilities (cultural, health, public safety, education, recreation, and utilities), transportation, land use and capability, housing, government, and community financial status were analyzed for the impact of oil and natural gas development. A composite model measured the overall effect of OCS development on the Alaskan economy. OCS direct output by 1993 represents 95% of the output of all other sectors, and 83.7% of the total employment impact of 21,890 is due to indirect and induced employment effects. If full employment at the start is assumed, wages would be pulled up. (Lynch-Wisconsin)
W78-02517

ECONOMIC AND FINANCIAL IMPACTS OF FEDERAL AIR AND WATER POLLUTION CONTROLS ON THE ELECTRIC UTILITY INDUSTRY.
Temple, Barker and Sloane, Inc., Wellesley Hills, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-254 308, Price codes: A22 in paper copy, A01 in microfiche. Report No. EPA 230/3-76-013, May, 1976, 539 p, 134 exhibits, 11 append. EPA 68/01/2803.

Descriptors: *Electric power industry, *Economic impact, *Pollution abatement, *Capital costs, *Air pollution, Water pollution control, Utilities, Baseline studies, User rates, Financing, Equipment, Costs, Projections.

An assessment is made of changes in the financial profile of the electric utility industry due to federal air and water pollution controls for 1975-90. The report covers the following: (1) historical overview 1960-75; (2) baseline projections 1975-85 excluding the effects of pollution control expenditures; (3) direct economic and financial effects of pollution control in terms of capital expenditures, external financing, and operating expenses; (4) availability of required capital financing; (5) regional variations in direct effects of pollution control; and (6) secondary effects resulting from increased costs and the operation of pollution control equipment. Major direct effects of pollution control regulations foreseen include: (1) capital expenditures will increase by $14.5 billion over the baseline from 1975-80 (a 12.3% increase), and by $25 billion from 1975-85 in 1975 dollars (10.5% increase); (2) scrubbers will account for over 50% of the $25 billion increase, followed by precipitators (25%) and cooling towers (16%); (3) external financing will increase by $14.5 billion from 1975-80 (16.1% increase), and $21.9 billion from 1975-85 (11.5%) (4) operating and management expenditures will annually increase 4% by 1980 and 6% 1985; (5) operating revenues and consumer charges will increase 5.4% by 1980 and 6.7% by 1985; (6) residential electric bills will increase by about $1.80 in 1980 and $2.80 in 1985 (excluding inflation). (Lynch-Wisconsin)
W78-02518

CHOOSING THE OPTIMUM FINANCIAL STRATEGY FOR POLLUTION CONTROL INVESTMENTS.
Environmental Protection Agency, Cincinnati, Ohio. Office of Technology Transfer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 443, Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA-625/3-76-005, June 1976. 59 p, 6 fig, 11 tab, 4 append.

Descriptors: *Pollution abatement, *Costs, *Economics, *Depreciation, *Taxes, Water pollution control, Industrial wastes, Equipment, Decision making, Waste water treatment, Industries, Management, Non-structural alternatives, *Financing, Tax incentives.

Various aspects of financing pollution control investment costs are discussed. Incentive or cost-reduction programs now available do not significantly reduce investment costs; but they can affect a company's cash flow and profit position. To a certain extent, the government passes industrial pollution control costs on to the public by exempting pollution control devices from certain sales, use, and property taxes, by permitting tax-exempt financing, and by special depreciation allowances. Moreover, the company's wastewater treatment costs can be reduced if a municipality treats the wastewater, due to federal construction grants to municipalities. The net present value (NPV) financial analysis technique is used frequently in this report. In a section on tax strategies several depreciation methods are evaluated, and it is shown that in most cases the double-declining balance and sum-of-the-years digits method is superior. In financing pollution control investments, the tax-free bond method is superior to both ordinary bank loans and SBA loans. Using the NPV technique, effects of combining various tax and financing strategies in three business situations are analyzed: (1) a manufacturer mainly interested in maximizing long-term profit; (2) a manager concerned with short-term profit impairment; and (3) a manufacturer with weak working capital. Financing and tax incentives in five states are described. (Lynch-Wisconsin)
W78-02519

THE COST OF CLEAN WATER IN AMMONIA, CHLORALKALI AND ETHYLENE PRODUCTION,
National Economic Models of Industrial Use and Waste Treatment Project, Houston, TX.
R. G. Thompson, S. A. Calloway, and L. Nawalanic.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 508, Price codes: A07 in paper copy, A01 in microfiche. Report No. NSF/RA-760234, 1976. 129 p, 30 fig, 23 tab, 54 ref, 3 append. GI-344592.

Descriptors: *Industrial wastes, *Water pollution control, *Chemical industry, *Ammonia, Industrial production, Costs, Pollution abatement, Model studies, Economic impact, Effluents, Waste water disposal, Cost-benefit analysis, Analytical techniques, Recycling, *Chlor-alkali, *Ethylene.

National economic policy models of three of the most important constituents of the chemical industry--ammonia, alkalies and chlorine (chlor-alkali), to eliminate discharge of pollutants to water, in terms of costs and alternate forms of pollution which could result. Zero discharge of pollutants to water was possible in the models through total recycle of wastewater, at production cost increases lower than generally supposed. The production cost increase in newly designed ammonia plants would be 3% ; in chlor-alkali plants (diaphragm cell process) the increase would be 5.6%, and in ethylene plants 7.7%. Establishing the zero discharge goal might stimulate investments in lower-cost production processes. An effluent stanard or tax for control of total dissolved solids was found to be the most cost-effective method of achieving zero discharge. Models of newly designed plants were developed to evaluate substitution possibilities in production, resource and energy use, input water treatment, wastewater treatment, and solid waste and brine managment. A new feature of these models is that they synthesize important technical data into a comprehensive economic analysis, enabling planners to evaluate effects of possible policy decisions on the use of resources, discharge of wastes, and production costs before the decisions are made. (Lynch-Wisconsin)
W78-02521

DIFFERING STATE STANDARDS AND WASTE TREATMENT COST,
Arkansas Univ., Fayetteville. Dept. of Civil Engineering.
D. Mitchell, and D. G. Parker.
Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol 103, No 3, p 389-396, June 1977. 8 tab, 8 ref.

Descriptors: *Federal Water Pollution Control Act, *Water quality standards, *State governments, *Industrial wastes, *Costs, Descriptors, State governments, Arkansas, Louisiana, Mississippi, Missouri, Oklahoma, Tennessee, Texas, Wastewater treatment, Benefits, Water quality control, Environmental effects.

The paper examines the water qulity standards established by seven selected states in an effort to assess how differences may affect the cost of industrial wastewater treatment. State standards examined are those of Arkansas, Louisiana, Mis-

sisippi, Missouri, Oklahoma, Tennessee and Texas. Differences are considered representative of those found in other states. It is concluded that water quality standards of various states are extremely variable with a virtual hodgepodge of minimal values given for almost any stream parameter. While some differences do not appear to significantly affect wastewater treatment cost, some can be shown to severely penalize local industries and may have deleterious effects on the economic stability and social well-being of citizens inhabiting those regions, without any apparent environmental enhancement. It is suggested that no real thought seems to have been given to what should really be the stream conditions that would fully enhance the environment without squandering resources on treatment for treatment's sake. (Coyle-Wisconsin)
W78-02523

PL 92-500 V. POLLUTION BY IRRIGATION RETURN FLOW,
National Enforcement Investigations Center, Denver, CO.
W. C. Blackman, Jr., C. G. Wills, and A. C. Celnicker.
Journal of the Irrigation and Drainage Division, Proceedings of ASCE, Vol 103, No 2, p 207-220, June 1977. 3 fig, 14 ref.

Descriptors: *Federal Water Pollution Control Act, *Federal Reclamation Law, *Irrigation districts, Irrigation practices, Pollution abatement, Water pollution control, Irrigation, Permits, Regulation, Administrative agencies, Governmental Interrelations, *National pollutant discharge elimination system, *Irrigation return flow, Effluent limitation.

The paper summarizes the problems of applying the municipal/industrial waste treatment oriented permit approach of the National Pollutant Discharge Elimination System to the control of irrigation return flow as embodied in the Federal Water Pollution Control Act Amendements of 1972. It is held that there must be acceptance and implementation of optimum application of irrigation water, even though optimum application may involve use of less than the prior appropriated water right. In the promulgation of regulations by the Environmental Protection Agency, the EPA should recognize that regional and delegated state administrators must have flexibility to designate permittees on the basis of logic. Since the Bureau of Reclamation plans, administers and operates many newly established irrigation projects, it is uniquely qualified to provide leadership and guidance toward optimum practices within project areas. In established irrigation districts and major irrigated areas, EPA should initiate a program of grants and contracts to enable optimum operation of plots representative of each area. Such recommendations and others will require modified viewpoints of irrigators, legislators, regulatory agencies and others. (Coyle-Wisconsin).
W78-02524

THE WELFARE EFFECTS OF EROSION CONTROLS, BANNING PESTICIDES, AND LIMITING FERTILIZER APPLICATION IN THE CORN BELT,
Texas A and M Univ., College Station. Dept. of Agricultural Economics and Rural Sociology.
C. R. Taylor, and K. K. Frohberg.
American Journal of Agricultural Economics, Vol 59, No 1, p 25-36, February 1977. 1 fig, 5 tab, 25 ref. EPA 68-01-3584.

Descriptors: *Erosion, *Federal Water Pollution Control Act, Pesticides, Herbicides, Insecticides, Water pollution sources, Political constraints, *Corn belt, *Linear program models, *Nonpoint pollution, Nitrogen fertilizer, Straight row cultivation, Soil loss.

A linear programming model of crop production in the Corn Belt was used to make partial welfare estimates of alternative erosion control methods. Reviewed were the partial welfare estimates of a ban on herbicides, a ban on insecticides, restrictions on nitrogen fertilizer, a ban on straight row cultivation, gross soil loss restrictions ranging from two to five tons per acre, and gross soil loss taxes of 50 cents a ton to $4 a ton. Pesticide and nitrogen policies are considered extreme but plausible using a strict interpretation of 1985 water quality goals set out in the amended 1972 Federal Water Pollution Control Act. The model used incorporated stepped demand functions for corn and soybeans, giving an approximate equilibrium solution for these markets. A soil loss tax is the least costly method for gaining soil loss reductions. But a per-acre restriction, considered politically more viable, was only slightly more costly for achieving up to a 50% reduction in erosion. A terrace subsidy policy was substantially less efficient that other policies reviewed. Future research is recommended on agricultural nonpoint pollution, with concentration on finding the optimal mix of point and nonpoint pollution. (Coyle-Wisconsin)
W78-02527

BENEFITS AND COSTS OF ENVIRONMENTAL PROGRAMS,
Harvard Univ., Cambridge, MA.
For primary bibliographic entry see Field 6B.
W78-02530

DEEP WELL INJECTION OF INDUSTRIAL WASTES: GOVERNMENT CONTROLS AND LEGAL CONSTRAINTS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.
W. R. Walker, and W. E. Cox.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 184, Price codes: A08 in paper copy, A01 in microfiche. Report NSF/RA-760316, 1976. 163 p, 2 tab.

Descriptors: *Injection wells, *Industrial wastes, *Waste disposal, Legal aspects, Groundwater, Waste water, Legislation, Institutional constraints, Civil law, Environmental effects, Pollutants, Underground storage, Monitoring, Administrative agencies, Controls, Hazards, Water pollution sources, Federal Water Pollution Control Act, Safe Drinking Water Act, Abandoned wells, Private property, Liabilities.

Although utilization of subsurface injection has increased in recent years as a result of intensified efforts to reduce the discharge of pollutants to surface waters, concern over possible adverse consequences has made this technique highly controversial. Extensive governmental involvement in injection well management has resulted from the inherent potential of such operations to produce negative environmental effects. In addition to government controls, private controls in the form of property rights and civil law bear heavily on the management and feasibility of waste injection programs. In light of federal legislation enacted since 1970 and the frequent changes of state control programs, this report surveys the range of legal options for injection well control and describes the institutional framework within which waste injection must be accomplished. Following a brief discussion of the environmental benefits and hazards of subsurface disposal, a detailed history of legislation and interpretation is presented. The report concludes with recommended guidelines for management and regulation, with reference to areas requiring further investigation. (Eberle-NWWA)
W78-02538

POSSIBLE CONTAMINATION OF GROUND WATERS BY OIL-AND GAS-WELL DRILLING AND COMPLETION FLUIDS,
Energy Research and Development Administration, Bartlesville, OK. Bartlesville Energy Research Center.
For primary bibliographic entry see Field 5B.
W78-02546

ENVIRONMENT--EXTERNALIZING THE INTERNALITIES,
City Univ. of New York. Graduate School and Univ. Center.
A. P. Lerner.
American Economic Review, Vol 67, No 2, p 176-178, March 1977. 5 ref.

Descriptors: *Economics, Pollution abatement, Prices, Allocation(Cost), Economic impact, *Pollution, *Pollution damage.

Abba Lerner debates Jerome Stein on pollution and the definition of pollution damage. Lerner takes pollution damage to mean utility losses for which those who suffer them are not paid or compensated. The appropriate amount would just compensate the victims for the utility losses. He says Stein's definition of pollution damage is not measured in terms of utility but in the environmental argument of the utility function, a physical argument in the utility function, according to Lerner. Lerner holds that the different physical units of environment cannot be treated as units of the same commodity. Each separate act of pollution must be judged and charged according to the damage to the utilities of the people affected. And he argues that no physical measure can be a substitute for this. (Coyle-Wisconsin)
W78-02560

COASTAL BELT TOURISM, ECONOMIC DEVELOPMENT AND ENVIRONMENTAL IMPACT,
For primary bibliographic entry see Field 6B.
W78-02564

LOCAL VERSUS NATIONAL POLLUTION CONTROL: NOTE,
Clarkson Coll. of Technology. Potsdam, NY. Dept. of Economics.
F. C. Menz, and J. R. Miller.
The American Economic Review, Vol 67, No 2, p 173-175, March 1977. 6 ref.

Descriptors: *Pollution abatement, *Prices, Allocation(Cost), Economics, Economic impact, *Social welfare function.

It is maintained that the existence of environmental spillovers from one locality to another is not a sufficient condition for nationwide uniformity of pollution damage prices. This contention is a response to an argument raised in another paper that in order to achieve economic efficiency in pollution abatement, the charge or price per unit of pollution damage must be the same in all localities. To assure this result, according to the earlier study, pollution control pricing decisions should not be the responsibility of local government. The paper holds that the earlier position is based on a rather restrictive specification of the social welfare function that does not allow for differences in regional preferences for environmental quality. If such differences exist, it is held that nationwide uniformity of prices for pollution damage is unlikely to be efficient, even when environmental quality is a national public good. (Coyle-Wisconsin)
W78-02566

CONTROLLING NONPOINT SEDIMENT SOURCES WITH CROPLAND MANAGEMENT: A NATIONAL ECONOMIC ASSESSMENT,
Arizona Univ., Tucson. Dept. of Agricultural Economics.

J. C. Wade, and E. O. Heady.
American Journal of Agricultural Economics, Vol. 59, No. 1, p. 13-24, February 1977. 6 tab, 11 ref. NSF-RANN GI-32990.

Descriptors: *Land management, Sedimentation, Land use, Water quality, Agriculture, Model studies, Non-structural alternatives, Water management(Applied), Water allocation(Policy), Economics, *Nonpoint pollution.

Use of cropland resources is one of the primary determinants of stream sediment water quality. To provide insights into the agricultural production system and potential requirements for improved water quality, five national sediment control policies were evaluated using models of the economics and physics of sediment to analyze the policies. Each evaluation examines change in U.S. agriculture resulting from the regulation of sediment loads. No single alternative examined gives a 'best' sediment control policy. Even the minimum alternative requires extreme changes in the production system. Optimum control based on cropland management can only be determined by evaluatig societal goals relating to food costs, environmental quality, farmer freedom, among other dimensions of resource use. Use of large scale models might significantly reduce costs of policy choices by anticipatig interactions and costs. But to the degree models are improperly formulated, implications may be wrongly stated. (Coyle-Wisconsin)
W78-02568

CITIZEN PARTICIPATION IN THE YORK RIVER BASIN STUDY: THE USE OF THE VALUE TRADE-OFF QUESTIONNAIRE,
Weston (Roy F.), Inc., Roslyn, NY.
K. J. Phillips.
Journal of Environmental Systems, Vol. 6, No. 3, p. 243-252, 1976-77. 1 fig, 2 tab, 9 ref.

Descriptors: *River basin development, Virginia, Planning, Surveys, Pollution abatement, Decision making, Social values, *Value trade-off questionnaire, *Public involvement, *York River Basin(VA), Public participation.

Effective environmental plans for a river basin can be accomplished only by including the public in the planning process. But conventional methods such as hearings, are not effective screening tools and often produce chaotic, confusing results. The paper describes a four-question value trade-off questionnaire administered to a group of 24 selected citizens, representing six different groups, in Virginia's York River Basin. Each question addressed a different trade-off germane to the selection of a Basin environmental plan. The questionnaire proved easy to administer and interpret, and provided a quantitative measure of people's preferences necessary for effective implementable planning. Among conclusions drawn from analysis of the responses were support for stringent effluent guidelines; a tie between economic development and increased level of clean-up, as no further increase in pollution would be tolerated; and support for the contention that clean-up costs are not excessive. The questions were also answered by the 24-member York Citizen Advisory Committee, formed by the Virginia Water Control Board. Answers by committee members did not differ from responses of other groups tested in the Basin. (Coyle-Wisconsin)
W78-02569

ENVIRONMENTAL QUALITY EFFECTS ASSOCIATED WITH SEASONAL HOME COMMUNITIES,
Pennsylvania Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 6B.
W78-02570

STATUS, PROBLEMS, ADVANCES AND ECONOMICS OF EUCHEUMA FARMS,
For primary bibliographic entry see Field 4A.
W78-02571

DEVELOPMENT DOCUMENT FOR EFFLUENT LIMITATIONS GUIDELINES AND NEW SOURCE PERFORMANCE STANDARDS FOR THE FISH MEAL, SALMON, BOTTOM FISH, CLAM, OYSTER, SARDINE, SCALLOP, HERRING, AND ABALONE SEGMENT OF THE CANNED AND PRESERVED FISH AND SEAFOOD PROCESSING INDUSTRY POINT SOURCE CATEGORY,
Environmental Protection Agency, Washington, DC. Effluent Guidelines Div.
E. H. Forsht.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 840, Price codes: A22 in paper copy, A01 in microfiche. Report No EPA 440/1-75/041-a, September, 1975. 485 p, 102 fig, 203 tab, 48 ref, 3 append.

Descriptors: *Effluents, *Baseline studies, *Fish, *Shellfish, Canneries, Salmon, Bottom fish, Herrings, Clams, Oysters, Shellfish, Water pollution control, Industrial wastes, Waste water treatment, *Federal Water Pollution Act Amendments(1972), *Seafood processing, Point pollution, Fish meal, Sardines, Scallops, Abalone.

Several sectors of the fish and shellfish processing industry were extensively analyzed to establish effluent limitation guidelines under the Federal Water Pollution Control Act Amendments of 1972. For 1 July 1977, (existing point sources) effluent reductions are those attainable through application of the 'Best Practicable Control Technology Currently Available' (BPCTCA), and for 1 July 1983 the 'Best Available Technology Economically Achievable' (BATEA). Sectors studied were fish meal, salmon, Bottom fish, sardines, herring, clams, oysters, scallops, and abalone. Wastes from all sectors were found to be amenable to biological waste treatment, and no materials harmful to waste treatment processes were found. With the exception of the fish meal industry, the level of waste treatment throughout the seafood industry is generally inadequate. Many plants in the contiguous states and virtually all Alaskan plants discharge solid and liquid wastes directly into receiving waters; others screen out only gross solids. Technology is available to enable most plants to comply with limitations by 1977. For the contiguous states the 1977 limitations are based on fine screening, housekeeping practices, and barging; for Alaska they are based on fine screening and barging of solids in nonremote areas, and comminutors or grinders in remote areas. For 1983 and for new sources additional technology includes physical/chemical and secondary treatment and in-plant controls. (Lynch-Wisconsin)
W78-02578

REMOTE SENSING REPORT, PACIFIC NORTHWEST AREA, WASHINGTON, OREGON, IDAHO, APRIL AND JULY 1973.
National Field Investigation Center, Denver, CO.
For primary bibliographic entry see Field 7B.
W78-02611

THERMOMETRY IN THE CONTROL OF WATER QUALITY,
National Bureau of Standards, Washington, DC.
For primary bibliographic entry see Field 5A.
W78-02618

FEASIBILITY OF RETURNING FLY ASH TO WESTERN MARYLAND FOR MINE RECLAMATION.
Maryland Environmental Service, Annapolis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 520, Price codes: A07 in paper copy, A01 in microfiche. Report No. ARC-74-139-MD-3202, December 1975. 128 p, 7 fig, 7 tab, 36 ref, 5 append. Prepared for Appalachian Regional Commission, Washington, D.C. ARC 74-139-MD-3202.

Descriptors: Chemical properties, Physical properties, *Fly ash, *Mining, *Land reclamation, Transportation, Mine acids, Mine drainage, *Maryland, Feasibility studies, Water pollution control, *Factor analysis.

A study was made of the feasibility of using fly ash from Maryland electric power plants to abate acid mine drainage and reclaim abandoned mines in Garrett and Allegany Counties in western Maryland. The study included a survey of abandoned and active mines to determine their suitability for fly ash reclamation projects, an evaluation of means of handling and transporting fly ash from power plants to the mines where it might be used, and evaluation of the physical and chemical properties of Maryland power plant fly ash pertinent to its suitability for mine reclamation, and evaluation of reclamation techniques using fly ash (particularly those associated with acid mine drainage abatement), and an evaluation of legal, institutional, and public factors pertinent to the development of a fly ash rail haul/reclamation project for western Maryland mines. Project development was not recommended on the basis of study results because of the limited number of viable uses of the fly ash and the high cost ($10/ton) of handling and transporting ash to western Maryland. Appendices give information on prospective mine sites, transportation systems, properties of fly ash related to reclamation, institutional considerations, and sources of information (contacts and references). (Wares-IPA)
W78-02620

SUPPLEMENTAL AERATION SYSTEM DESIGN FOR THE HOUSTON SHIP CHANNEL,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
T. W. Hoskings, T. D. Reynolds, and R. W. Hann, Jr.
Sea Grant College Report No. TAMU-SG-78-201, October 1977. 220 p, 45 fig, 26 tab, 73 ref, 7 append. SG-04-6-158-44012.

Descriptors: *Aeration, *Waste treatment, *Oxygenation, Mathematical models, Texas, Water pollution control, *Houston Ship Channel(Tex), Dissolved oxygen, Ship channels.

The oxygen demand on the Houston Ship Channel exceeds its natural assimilative capacity. Dissolved oxygen (DO) is depleted so that warm weather and low flow commonly produce zero DO concentration in the upper 14 miles of the channel. This study develops and demonstrates a technique for designing an in-channel supplemental aeration system that might be considered as an alternative to advanced waste treatment. A mathematical model is used to calculate the capacity of supplemental aeration systems and to locate aeration equipment for maximum efficiency. Accurate simulation of oxygen dynamics is critical, and extensive effort is made in modeling oxygen sources and sinks. Model verification is conducted under both steady state and dynamic conditions. A general system design consisting of required oxygen transfer capacities under critical and average conditions, and site locations are developed. Sidestream oxygenation, diffused aeration, diffused oxygen, and surface aeration systems are evaluated for their ability to meet the requirements of the general design, for their economic desirability, and for their physical feasibility. (NOAA)
W78-02645

OHIO EPA WATER QUALITY STUDIES IN THE SANDUSKY RIVER BASIN,
Ohio State Environmental Protection Agency, Bowling Green. Northwest District Office.
G. Martin.

In: Proceedings of Sandusky River Basin Symposium, Held at Tiffin, Ohio on May 2-3, 1975. p 100-122, 2 fig, 2 tab, 8 ref.

Descriptors: *Water quality control, *Water quality, *Planning, Rivers, *River basins, Pollution abatement, Legislation, Regulation, Permits, Effluents, Discharge(Water), Data collection, Ohio, *Sandusky River Basin(Oh), *Point pollution, Water quality studies, National Pollutant Discharge Elimination System, NPDES.

An important component of Ohio's federally-required water quality management continuing planning process is the state EPA's water quality studies. Federal approval of each state's continuing planning process is required for the state to issue discharge permits under the National Pollutant Discharge Elimination System (NPDES). This federal approval is contingent on state maintenance of an adequate water quality monitoring system. The Ohio EPA's survey of the Sandusky Basin was carried out in 1974. Sixteen locations on the Sandusky River and 18 tributaries were sampled from April to December. Point-source pollution was emphasized rather than agricultural and urban runoff, as sampling concentrated on moderate to low-flow regimes (June-October). There are 15 municipal and semipublic dischargers, 27 direct industrial dischargers, and 14 municipal water treatment plants in the basin. Four of the sewage treatment plants and five of the industries discharge more than one million gallons per day. Inadequate municipal sewage treatment and combined sewer overflows were the prime factors in heavy pollution encountered in the Sandusky River below Bucyrus, Muskellunge Creek at Fremont, Spring Run below Carey, and Paramour Creek below Crestline. Fecal coliform bacteria, dissolved oxygen, and ammonia were the most frequent violations. Most other areas appear to have water quality capable of supporting a variety of warm water fish. Extensive statistical data are presented in tables. (See also W78-01528) (Lynch-Wisconsin)
W78-02649

AQUATIC VASCULAR PLANTS OF THE SANDUSKY RIVER BASIN,
Ohio State Univ., Columbus. Dept. of Botany.
R. L. Stuckey.
In: Proceedings of the Sandusky River Basin Symposium, Held at Tiffin, Ohio on May 2-3, 1975. p 295-333, 3 fig, 3 tab, 36 ref.

Descriptors: *Aquatic plants, *River basins, Rivers, Bays, Streams, Watershed(Basins), Ohio, History.
Identifiers: *Sandusky River Basin(Oh), *Vascular plants.

A study of aquatic vascular plants in the Sandusky River Basin in Ohio includes a historical survey of literature describing vegetation in the basin. Sandusky basin wetlands can be categorized as (1) remnants of original wet prairie, marshes, swamps, peat lands, and cranberry bogs in the upper portion of the basin; (2) remnants of dike marshes at the upper end of Sandusky Bay; (3) Sandusky River and its tributaries; and (4) man-created drainage ditches, reservoirs, and ponds. Field research conducted between 1967 and 1969 recognized about 240 species of aquatic vascular plants in the basin. Of these 58 (24%) are common, 68 (28%) are rare and localized, and 30 (13%) are believed extirpated. The greatest diversity in species composition is found in the marshes of Sandusky Bay, where also the greatest variation in habitats is found. However, increased turbidity in the bay in the last century has eliminated or reduced the numbers of many submerged plants. The former bogs once dominated by the American cranberry, were drained after 1855. The Sandusky River and tributaries contain many of the aquatic species that occur in the remnant original wetlands, but submersed plants are generally absent due to turbidity and silted bottoms. Species composition in the ditches, reservoirs, and ponds is virtually unknown. (See also W78-01518) (Lynch-Wisconsin)
W78-02650

PROCEDURES FOR EVALUATING OPERATIONS OF WATER MONITORING NETWORKS,
URS Research Co., San Mateo, CA.
For primary bibliographic entry see Field 5A.
W78-02656

PROTOTYPE SYSTEM FOR PLUGGING LEAKS IN RUPTURED CONTAINERS,
Rockwell International, Canoga Park, CA. Rocketdyne Div.
J. J. Vrolyk, R. C. Mitchell, and R. W. Melvold.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 245, Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA-600/2-76-300, December 1976. 111 p, 36 fig, 5 tab, 7 ref, 2 append. 1BB610, EPA 68-03-0234.

Descriptors: *Water pollution, *Leakage, Accidents, Hazards, Transportation, Sealants, Chemicals, Pollution abatement, Prototype tests, Evaluation, Rupturing, Failures, *Hazardous materials, Spills, Plugs, Foams.

A prototype leak-plugging system, developed to temporarily stop the flow of hazardous materials spilling on land or under water from ruptured or damaged containers, was successfully tested. The system, portable, integrated and field operable by one person, uses foamed-in-place polyurethane rigid foam plugs surrounded by a flexible protective membrane for sealing leaks. An applicator tip attached to a long handle is placed into the leak. The foam delivery system is then actuated and the foam chemicals, which are stored in a backpack, are automatically mixed and forced through a delivery tube and into the applicator tip expanding it both inside and outside the tank. The foam hardens in a few minutes and locks the plug in place. The applicator is then detached from the delivery system, which can then be refilled with foam chemicals and used again with a new applicator. The prototype leak plugging system from this project is considered developed to the point that it is realistic to project practical field use of the system. A preliminary implementation plan, including recommendations for additional work needed, is outlined. (Wares-IPA)
W78-02657

PLANNING FOR URBAN STORMWATER CONTROL, (PART III),
Fell, Brusso, Bruton and Knowles, Inc., Tulsa, OK.
W. J. Fell.
Public Works, Vol. 108, No. 10, p 90-93, October, 1977.

Descriptors: *Storm water, *Analytical techniques, *Hydrograph analysis, *Rainfall-runoff relationships, *Time of concentration, Surface runoff, Overland flow, Urban runoff, Topography, Mathematical models, Storm runoff, Hydrographs.

A method for deriving the time of concentration or the time required for water to travel from the farthest part of a watershed to its drainage is presented for use in calculating the shape of a storm water hydrograph. A series of equations for expressing peak flood flows as functions of the area of the given watershed, the slope, and the average annual precipitation is given. An equation for the volume of flow or the area under the hydrograph is used to derive the runoff per sq mile and the time to peak. Inches of runoff are computed for recurrence intervals of 10, 25, 50, and 100 yrs and losses are subtracted for depression storage, infiltration, interception, and evapotranspiration. The Tulsa area in Oklahoma is used to illustrate computation of time of concentration, channel length, and slope is presented graphically for 10- and 25-yr storms. (Schulz-FIRL)
W78-02660

GROUND-WATER CONTAMINATION: PROBLEMS AND REMEDIAL ACTIONS,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 5B.
W78-02675

RELATIONSHIP OF REGROWTH OF AQUATIC MACROPHYTES AFTER TREATMENT WITH HERBICIDES TO WATER QUALITY AND PHYTOPLANKTON POPULATIONS,
Florida State Game and Fresh Water Fish Commission, Eustis.
C. C. Carter, and R. S. Hestand.
Journal of Plant Management, Vol 15, p 65-69, June 1977. 3 fig, 1 tab, 11 ref.

Descriptors: *Herbicides, *Dequat, *Aquatic weed control, Florida, Phytoplankton, Water quality, Chara, Submerged plants, Bacteria, Ecosystems, Toxicity, Succession, Recreation, *System E, *Hydrothol 191, *TD-1874, Endothall, Coontail, Ceratophyllum demersum, Vallisneria americana, Hydrilla verticillata, Myriophylluim-spicatum, Water milfoil, Najas guadalupensis.

Tests of four herbicides in plastic pools containing combinations of six submersed plant species with 100% cover indicated that 116-280 days after a total treatment macrophyte recovery and ecological stabilization was achieved, but at only 29-40% of the original cover. Based on test results, 40-50% of a multiple-use recreational lake should be kept vegetated, with 50-60% in open water. The four herbicides tested were TD-1874, Hydrothol 191, System E, and Diquat with Cutrine Plus. Plants included coontail (Ceratophyllum demersum), muskgrass (Chara sp.), eelgrass (Vallisneria americana), Hydrilla verticillata, Eurasian water milfoil (Myriophyllum spicatum), and southern naiad (Najas guadalupensis). Pools were planted in August 1974 in central Florida and allowed to stabilize for one year. By the ninth day after treatment all plants in all of the treated pools were dead and decomposing, with the exception of pools treated with System E, which did not affect muskgrass. Treatment with the other three herbicides resulted in water with high turbidity and putrid odors as anaerobic sulfur bacteria liberated H2S byproducts. A total kill of plants, fish, and invertebrates resulted in an explosive growth of bacteria and phytoplankton. In System E pools, however, the persistence of muskgrass kept water quality and phytoplankton levels similar to the control. With macrophyte recovery, turbidity, pH, orthophosphate, and total organic nitrogen returned to normal. Relative species dominance was significantly changed by the treatments. (Lynch-Wisconsin)
W78-02676

AQUATIC HERBICIDE CHRONICITY,
Creative Biology Lab., Inc., Barberton, OH.
S. A. Quinn, N. F. Cardarelli, and E. O. Gangstad.
Journal of Aquatic Plant Management, Vol 15, p 74-76, June 1977. 4 tab, 8 ref. Corp of Engineers DACW 73-73-C-0042.

Descriptors: *Aquatic weed control, *Herbicides, *Rates of application, *Diquat, Lethal limit, Toxicity, Chemcontrol, *Chronicity, *2 4-D BEE, *Silvex, Water milfoil, Myriophyllum spicatum, Vallisneria americana, Elodea canadensis, Slow-release treatment.

In an effort to determine feasibility of slow-release herbicide application, low concentrations of three herbicides were applied on a long-term basis to various aquatic plant species to first find the

minimum lethal repeated dosage. Matrix analysis of the data indicated that the application rate, concentration, type of herbicide, method, and exposure time were highly significant, whereas differences due to individual plant species were relatively small. Diquat, 2,4-D BEE, and silvex were tested on Eurasian water milfoil (Myriophyllum spicatum), wild celery (Vallisneria americana), and waterweed (Elodea canadensis) under laboratory conditions. It was possible to demonstrate chronic effects of the herbicides at 1.0, 0.1, and 0.01 ppm concentrations. A field application of 0.1 ppm would probably be an effective level for operational control. Exposure times for diquat, 2,4-D BEE, and silvex are estimated at 19, 23, and 27 days respectively, under accumulative treatment conditions, although field trials would be essential. Two basic experiments were performed: (1) the herbicides were added daily so that the dose would be accumulative for each rate of application; (2) the testwater was changed every other day to ensure a constant concentration for each application rate. (Lynch-Wisconsin)
W78-02677

RESTORATION OF WATER QUALITY IN LAKE WESTON, ORLANDO, FLORIDA,
Orange County Pollution Control Dept., Orlando, FL.
J. M. Bateman, and R. L. Laing.
Journal of Aquatic Plant Management, Vol 15, p 69-73, June 1977. 7 fig, 2 tab, 9 ref.

Descriptors: *Nutrient removal, *Eutrophication, *Algal control, *Calcium, *Aeration, Florida, Phosphorus, Nutrients, Sewage effluents, Algae, Phytoplankton, Stratification, Equipment, Methodology, Water purification, *Lake Weston(FL), Lake Lovely(FL), Lake Lawne(FL).

Lake Weston, a 11.3 ha, 15-m deep eutrophic lake in Orlando (FL) was treated with aeration and a nontoxic soluble calcium compound to precipitate phosphorus and make it unavailable for plant assimilation. Aeration raised bottom dissolved oxygen to > 3 mg/l, bottom ammonia to < 0.11 mg/l, and pH to > 6.5 to prepare the water for phosphorus removal using the calcium-based precipitant. Phosphate is continually combining with natural calcium in the water, but redissolves when it reaches the anoxic bottom water. By the end of the 18 month treatment period, initiated in June 1975, three-year water quality goals for dissolved oxygen (DO), total nitrogen, ammonia nitrogen, orthophosphate, and biochemical oxygen demand were exceeded, while goals for chlorophyll-a and total phosphate were nearly achieved. Aeration alone resulted in improved environment for fish, decrease in aquatic plant nutrient levels, and an apparent decrease in bottom muck. Besides nitrogen and phosphorus reduction, reduction in alkaline earth metals probably helped control phytoplankton. The cause of eutrophication in the lake, which previously had been polluted by sewage effluent, was stratification resulting in an inadequate supply of bottom DO, persistence of noxious gases, and accumulation of anaerobic acids. The aerators consisted of an 0.5 Hp piston air compressor connected to lake bottom ceramic diffusers by plastic tubing. (Lynch-Wisconsin)
W78-02678

EFFECTS OF SEASON AND WATER DEPTH ON EURASIAN WATERMILFOIL,
Tennessee Valley Authority, Muscle Shoals, AL. Environmental Biology Branch.
R. A. Stanley, E. Schackelford, D. Wade, and C. Warren.
Journal of Aquatic Plant Management, Vol. 14, June 1976, p. 32-35. 5 fig, 30 ref.

Descriptors: *Reservoirs, *Seasonal, *Depths, *Tennessee Valley Authority, *Aquatic weed control, *Rooted aquatic plants, Eutrophication, Standing crops, Spatial distribution, Water temperature, Biomass, Nuisance algae, Contours, Aquatic weeds, Tennessee, Alabama, *Eurasian watermilfoil, *Myriophy-lum spicatum, *Watermilfoil, Melton Hill Reservoir(Tenn), Guntersville Reservoir(Ala).

Samples of Myriophyllum spicatum L. collected for one year at four-week intervals in two Tennessee Valley Authority reservoirs were investigated in terms of season and contour levels and their effects on distribution. The reservoirs were Melton Hill near Oak Ridge, Tenn., and Guntersville, near Scottsboro, Ala. Ash-free dry weight per sq m was related to month and elevation above mean sea level. In both reservoirs a spring growth phase began in May, but a fall decline occurred earlier in Guntersville (August-September) than in Melton Hill (October-December). A winter regrowth and early spring decline occurred in Melton Hill, but not in Guntersville, where growth remained relatively constant. Maximum standing crop in Melton Hill was consistently about three times as great as in Guntersville, which may indicate that Melton Hill's greater water level fluctuation and shorter colonization time is favorable to the growth of Eurasian watermilfoil. Effects of temperature on growth were inconclusive. Greatest growth density occurred between contour elevations of about 240.0 m and 239.6 m during most of the year. In winter, however, heavy growth was noted up to about 241.0 m. Sharp declines in density were noted above and below these limits. (Lynch-Wisconsin)
W78-02680

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

A MULTI-PARAMETER WATER QUALITY MANAGEMENT MODEL FOR RIVER BASINS,
Cornell Univ., Ithaca, NY. Center for Environmental Research.
For primary bibliographic entry see Field 5G.
W78-02202

OPTIMAL ALLOCATION AND MANAGEMENT OF AGRICULTURAL WATER,
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W78-02226

COMPUTER MODELING TO MAXIMIZE WATER USE EFFICIENCY AND REDUCE ENERGY IN IRRIGATION,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W78-02404

VALUE OF INFORMATION IN RESERVOIR OPTIMIZATION,
Department of the Environment, Ottawa (Ontario). Hydrology Research Div.
For primary bibliographic entry see Field 4A.
W78-02445

OPTIMAL CAPACITY EXPANSION WITH OFF-DESIGN COSTS,
California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 3A.
W78-02450

RECREATION MANAGEMENT: A PROGRAMMING EXAMPLE,
Victoria Univ. (British Columbia). Dept. of Economics.
For primary bibliographic entry see Field 6B.
W78-02528

A STATUS GROUP DYNAMICS APPROACH TO PREDICTING PARTICIPATION RATES IN REGIONAL RECREATION DEMAND STUDIES,
Wisconsin Univ.-Green Bay. Leisuer Sciences and Sociology.
For primary bibliographic entry see Field 6B.
W78-02561

AN OPERATIONAL APPROACH TO MULTIPLE OBJECTIVE DECISION MAKING FOR PUBLIC WATER RESOURCES PROJECTS USING INTEGER GOAL PROGRAMMING,
North Carolina Univ. at Greensboro. Dept. of Business Administration.
W. P. Neely, R. M. North, and J. C. Fortson.
American Journal of Agricultural Economy, Vol. 59, No. 1, p. 198-203, February 1977. 5 tab, 13 ref.

Descriptors: *U.S. Water Resources Council, *Decision making, *Project planning, Multiple-purpose projects, Planning, *Integer goal programming, Environmental quality, Problem identification and ranking.

A variation of linear programming called integer goal programming is proposed as a quantitative approach to integrate multiple objectives in the selection and scheduling of federally funded water resources projects. Deviations from target levels of both economic and environmental objectives may be minimized by using the method to evaluate projects under the proposed multiple objectives. Integer goal programming permits decisionmakers to specify and to change the priorities given each goal and to select only complete rather than partial projects in multiple period funding of multiple objective projects. It is suggested that the approach is capable of incorporating environmental, regional, economic and national economic factors. Political factors and other qualitative parameters of a social and environmental nature can be built into the model as constraints or as additional goals. It is possible to make trade-offs, and observe changes in costs, benefits, and net values. (Coyle-Wisconsin)
W78-02575

6B. Evaluation Process

THE ALLOCATION OF A NATURAL RESOURCE WHEN THE COST OF A SUBSTITUTE IS UNCERTAIN,
Ohio State Univ., Columbus.
D. A. Hanson.
Annals of Economic and Social Measurement, Vol. 6, No. 2, p. 189-201, 1977. 5 fig, 3 ref. Natl. Science Foundation GK-40298.

Descriptors: *Resource allocation, Economics, Costs, *Risks, Mathematical models, Capital, Natural resources, Economic efficiency, Risk neutrality, Risk aversion.

This paper deals with the theoretical problem of how much resource to use initially, and what mix of reproducible capital and remaining resource stock will maximize future welfare in a situation where a substitute for an exhaustible natural resource can be produced only at unknown cost. Through mathematical derivations the conclusion is reached that for linear homogeneous production functions and classes fo strictly concave production functions and with risk neutrality, future welfare is improved with more capital and less resource when the cost is uncertain; i.e., more resource should be used initially. The effect of risk aversion is in the opposite direction. For sufficiently strong risk aversion, the direction of shift in desired future assets can be reversed. The paper postulates a production possibility frontier between capital and resources available for the future. In a world of certainty, the efficient mix of

assets is determined by the Hotelling condition, which is that the ratio of the net marginal product of the resource between any two periods must equal the marginal rate of transformation of capital between those periods. (Lynch-Wisconsin)
W78-02209

DIVIDING OCEAN RESOURCES: A DEVELOPMENT AND APPLICATION OF THE THEORY OF FACTOR TRANSFER,
University of Western Ontario, London.
For primary bibliographic entry see Field 6C.
W78-02212

A CRITIQUE OF THE NATIONAL WATER COMMISSION ANALYSIS OF COST SHARING,
Cornell Univ. Agricultural Experiment Station, Ithaca, NY. Dept. of Agricultural Economics.
W. Hunt, E. Cohn, and D. J. Allee.
Cornell Agricultural Economics Staff Paper No. 76-16, April 1976. 1 fig, 111 ref.

Descriptors: *National Water Commission, *Cost sharing, Municipal water, Irrigation water, Navigation, Flood control, Regional development, Competition, Model studies, Electric power, Recreation water sports, Municipal wastes, Low-flow augmentation, Cost sharing historical origins, Economic competitive market model.

The 1973 National Water Commission's review and recommendations on cost sharing policies for water development projects is analyzed and alternative recommendations are offered. A competitive economic market model used by the Commission is considered simplistic and inappropriate and ignores profound exceptions; it is argued that the Commission relies on a doctrinaire political model of state supremacy that disregards opportunities for redrafting federal programs to meet state needs. Counter recommendations are given, stating that the need for water resource programs and implementing strategies should be established by political process involving federal, state and local governments, and that once the political process is set, cost sharing appropriate to the specific program should be undertaken. Also, a clear understanding is needed of the goal of federal cost sharing as it related to a specific program. Counter recommendations include cost sharing aspects, cover municipal water, irrigation water, navigation, electric power, water based recreation, municipal waste collection and treatment, flood control, environmental values, regional development and low flow augmentation. (Coyle-Wisconsin)
W78-02214

COAL, ENERGY STUDY ISSUE, UPDATE, 1976,
Wyoming Univ., Laramie. Water Resources Research Inst.
For primary bibliographic entry see Field 3E.
W78-02225

ECONOMIC/DEMOGRAPHIC ASSESSMENT MANUAL: CURRENT PRACTICES, PROCEDURAL RECOMMENDATIONS, AND A TEST CASE,
Arizona State Univ., Tempe. Dept. of Economics.
J. A. Chalmers, and E. J. Anderson.
Prepared for Bureau of Reclamation, Engineering and Research Center, Denver, Colo., November 1977. 300 p. Bur Reclam 7-07-DR-50180.

Descriptors: Cohort-survival population projections, *Construction period, Impact assessment, Economic base analysis, Economic, *Demographic assessment, *Forecasting, *Environmental impact assessment, Fiscal impact analysis, Planning, *Population projection, Simulation modeling, Socio-economic assessment, Water resource development projects.

Problems associated with projecting the population, employment, and income impacts of both the construction and the operation phases of water resource development projects were studied. The manual consists of three sections. Survey of Current Practices. A large number of environmental assessments and planning reports are reviewed. Methods currently being used for economic and demographic analysis are described. Procedural Recommendations. Based partly on current practices and partly on the professional social science literature, a set of procedural recommendations are made for carrying out economic/demographic assessments. Important methodological options are identified and evaluated as they apply to the different steps in the projection and assessment process. Test Case. The procedural recommendations are demonstrated by applying them to a proposed desalting plant near LaVerkin, Utah. The organization of the assessment follows the procedural recommendations and illustrates the way in which many of the practical problems of an actual assessment can be met. Each of the three major sections of the manual is organized around a seven-step procedure for carrying out an economic/demographic assessment. (1) Description of the Existing Economic/Demographic Environment; (2) Baseline Economic/Demographic Projections; (3) Description of the Proposed Action; (4) Population, Employment, and Income Impacts of the Proposed Action; (5) Community Population Impacts; (6) Community Facilities Impacts; (7) Fiscal Impacts. (See also W78-02275) (Bur of Reclam)
W78-02274

BUREAU OF RECLAMATION, CONSTRUCTION WORKER SURVEY,
Arizona State Univ., Tempe. Dept. of Economics.
J. A. Chalmers.
Prepared for Mountain West Research, Inc., under contract to Bur Reclam, Eng and Res Ctr, Denver, Colo., October 1977. 70 p, 1 fig, 11 tab, 3 append. Bur Reclam 7-07-DR-50180.

Descriptors: *Construction period impact assessment, Housing requirements, *Construction workers, *Population influx, Unemployed labor resources, *Water resource development projects, *Surveys.

Problems associated with estimating the economic and demographic impacts arising out of project construction activities were studied. Methodological problems and procedures are discussed in a report entitled the Economic/Demographic Assessment Manual. The construction worker survey is an attempt to obtain empirical observations on key characteristics of Bureau of Reclamation construction workers. A survey was conducted during the summer of 1977 and was designed to determine the characteristics of construction workers and their families; the distribution of the construction force between local and nonlocal workers; the extent to which nonlocal workers were accompanied by their families; the way in which the local residences of the nonlocal workers were distributed; and, finally, to investigate the previous employment status of local workers. (See also W78-02274) (Bur Reclam)
W78-02275

THE ARIZONA WATER RESOURCES COMMITTEE: HISTORY AND POLITICS,
Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 6E.
W78-02400

WATER CONSERVATION IN CALIFORNIA.
California State Resources Agency, Sacramento. Dept. of Water Resources.
For primary bibliographic entry see Field 3B.
W78-02409

THE CALIFORNIA DROUGHT - 1976.
California State Resources Agency, Sacramento. Dept. of Water Resources.
For primary bibliographic entry see Field 3B.
W78-02410

THE CALIFORNIA DROUGHT - 1977, AN UPDATE.
California State Resources Agency, Sacramento. Dept. of Water Resources.
For primary bibliographic entry see Field 3B.
W78-02411

THE CONTINUING CALIFORNIA DROUGHT.
California State Resources Agency, Sacramento. Dept. of Water Resources.
For primary bibliographic entry see Field 3B.
W78-02412

BOATS AND THEIR PEOPLE. A STUDY OF RHODE ISLAND BOAT OWNERS,
Rhode Island Univ., Narragansett. Dept. of Resource Economics.
N. Rorholm.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 735, Price codes: A03 in paper copy, A01 in microfiche. Marine Technical Report 52, July 1976, 31 p. 12 tab. SG-04-5-158-6.

Descriptors: *Rhode Island, *Boating, *Recreation demand, Boats, Recreation, Social aspects, Surveys, Recreation facilities, Fishing, Marinas, Income.

A questionnaire survey of 931 Rhode Island Owners of engine-powered boats conducted for the 1973 season provides information on average household incomes, length of residence, influence of boating interest in choice of town in which to live and various other aspects. The household income of 45% of Rhode Island boat owners in over $15,000, compared with 41.7% for New England, and 38.6% for the United States as a whole. By occupation, the distribution of boat ownership is: professionals and administrators, 35%; craftsmen and laborers, 34%; proprietors, 11%; retired, 11% clerical and sales, 9%. There was little difference in family size by type of boat (3.3-3.6), but inboard powerboat or inboard sailboat owners tended to be older (49,46) and have owned their boats longer (16,15 years) than outboard owners (43,42 average age; 12, 10 years ownership). Owners of sailboats with inboard power had the highest average income, $28,613, while outboard powerboat owners had the lowest, $15,942. Some 40% of the respondents indicated that their boating interest positively influenced their decision of where to live, varying from 33% for those with an average income of $15,942 to 61% years for outboard sailboat owners to 23 years for inboard powerboat owners. (Lynch-Wisconsin)
W78-02520

RECREATION MANAGEMENT: A PROGRAMMING EXAMPLE,
Victoria Univ. (British Columbia). Dept. of Economics.
G. R. Walter, and J. A. Schofield.
Land Economics, Vol 53, No 2, p 212-225, May 1977. 4 tab, 15 ref.

Descriptors: *Ecosystem, Dynamic programming, Recreation facilities, Recreation demand, Use rates, Prices, Social needs, Non-consumptive use, Canada, *Bowron Lake Provincial Park, *Wilderness recreation management, British Columbia, Tourist expenditures, Policy analysis, Multiple objectives planning.

A programming model is developed as an aid in making decisions on the operation of a wilderness recreation area. There is an empirical development of the model in reference to Bowron Lake Provin-

cial Park in the central interior of British Columbia. Resource management is treated as a case of welfare maximization in a framework allowing a broad range of issues to be examined. Specifically the approach makes possible a review of various policy judgements on visitor use, appropriate user charges, and restrictions on use arising out of consideration of congestion and environmental impact. It is noted, however, that the paper does not deal with investment to provide for more visitors, the treatment of time periods, and environmental impact. In the latter case it is contended that a sophisticated endogenous treatment of ecological capacity is not yet feasible. It is stressed that the approach developed is not designed to produce easy solutions but to provide information on likely effects of different policies as an aid in determining preferred policy. (Coyle-Wisconsin)
W78-02528

BENEFITS AND COSTS OF ENVIRONMENTAL PROGRAMS,
Harvard Univ., Cambridge, MA.
R. Dorfman.
Society, Vol. 14, No. 3, March-April 1977, p. 63-66. 3 tab.

Descriptors: *Pollution abatement, *Cost-benefit analysis, *Cost allocation, Costs, Benefits, Cost analysis, Expenditures, Economics, Progressive taxes, Social impact, Social aspects.

In 1972 total outlays for pollution control in the United States amounted to about $19 billion. About two-thirds was paid by private and government enterprises, with the remaining third divided about equally between direct costs to households and government costs at all levels. However, all the costs are ultimately borne by households through taxes and price increases. Based on estimates of the Public Interest Economics Center and survey data of the National Wildlife Federation, the average per-family cost for pollution control is $121 for incomes under $5,701, $205 for $5,701-11,410, and $549 for over $11,410 while average willingness to pay for pollution control is $60, $214 and $608 respectively. It is socially and politically harmful to compel citizens to pay more for government programs than they are willing to, defined as 'exaction.' For families under $5,701 and $61 exaction comes to a total of some $600 million. A hypothetical example of four towns polluting a lake shows that the most efficient method of reducing pollution (i.e., least costly) may well not provide the lowest exaction rate. Which of various trade-offs is chosen depends on relative valuations placed on economic efficiency and equity. It is argued that progressive abatement measures are most desirable; upper income households should bear more of the burden, especially in water pollution control. Regressive methods for automative emission control are probably unavoidable. (Lynch-Wisconsin)
W78-02530

TRENDS IN OUTDOOR RECREATION ACTIVITY PARTICIPATION: IMPLICATIONS FOR PLANNING,
Wisconsin Univ.-Madison. Coll. of Agricultural and Life Sciences.
N. Enosh, and A. Somersan.
Journal of Soil and Water Conservation, p 267-272, November-December, 1976. 3 fig, 5 tab, 8 ref.

Descriptors: *Recreation, *Surveys, *Attitudes, Recreational facilities, Planning, Camping, Swimming, Fishing, Hunting, Boating, Central U.S., Human population, Hiking, Horseback riding, Picnicking, Age-cohort groups.

Since most outdoor recreation activities are free or priced artificially low, there is no market mechanism for automatically allocating resources. This project was designed to determine the validity of using current outdoor recreation participation data for predicting future trends. Participation patterns of 12 to 17 year olds over five decades were determined on the basis of a telephone survey of 6,440 households (with 11,460 adults over 18) in nine mid-western states. Age-15 cohort groups were established for : 1921-30, 1931-40, 1941-50, 1951-60, and 1961-70. Respondents were asked which of these recreation activities they participated in during their youth: swimming, fishing, camping, hiking, horseback riding, picnicking, hunting, and boating. Results were analyzed by sex, race, urban/rural, water sports facilities near residence, and membership in youth organizations. Participation rates overall for hunting, fishing, and picnicking were found to be stable; swimming and camping increasing rapidly; boating increasing slowly; and horseback riding and hiking showing varying trends. Sex was the strongest factor affecting participation. Females dominated swimming, picnicking, hiking, and horseback riding; males dominated hunting, fishing, and camping; and boating was neutral. The study found no general trend in participation that could be applied to all outdoor recreation activities. (Lynch-Wisconsin)
W78-02531

STRUCTURE OF DEMAND FOR OUTDOOR RECREATION,
Economic Research Service, Tucson, AZ. Natural Resources Economics Div.
R. L. Gum, and W. E. Martin.
Land Economics, Vol. 53, No. 1, p 43-55, February, 1977. 1 tab, 6 ref.

Descriptors: *Recreation, *Attitudes, *Arizona, *Demand, Elasticity of demand, Hunting, Surveys, Planning, Fishing, Camping, Statistical methods, Analytical techniques, Cluster analysis.

A method for analyzing the structure of demand for outdoor recreation is developed and applied to a stratified random sample (2,926 respondents) representing the Arizona population. Cluster analysis provided a means of reducing 49 variables to eight dimensions or 'clusters'. On the basis of these dimensions the population was grouped into eight recreation types having similar tastes and preferences. Such traditional variables as income and education, while more quantifiable, have been found to be unreliable indicators or recreational activity. Instead, the data showed that the outdoor recreation activity of about 70% of the population of Arizona is affected mostly by tastes and preferences. They have adequate incomes and vacation times, but their recreation is determined by such factors as attitude toward killing wildlife and the general interest of the family in outdoor activities. For some 11% of the population, primarily retired people, recreation is determined mainly by their concern with age. Only 19% of the sample was considered 'elastic', i.e., would increase their recreational activities if they had higher incomes or more vacation time. A shift in this group from one recreation type to another because of more leisure time or higher income would affect the demand structure significantly. Consideration of alternate scenarios due to this elasticity can be useful in planning. (Lynch-Wisconsin)
W78-02532

HOW TO ESTIMATE THE SOCIAL RATE OF DISCOUNT,
Harvard Univ., Cambridge, MA.
R. Dorfman.
Discussion Paper 442. Harvard Institute of Economic Research, Harvard University, 1975. p. 1-14. 1 fig, 2 tab, 5 ref.

Descriptors: *Discount rates, *Resource allocation, Economics, Cost allocation, Resources development, *Social rate of discount, *Utility rate of discount, *Consumption rate of discount, Social welfare, Per capita consumption, Marginal utility.

An estimate of the social rate of discount assumes that measurable social welfare exists and that societies maximize the integral of social welfare over time. The measure is welfare corresponding to the average level of consumption. Utility is scaled from zero at the povery line to a maximum of 100. Two rates of social discount are established, the utility and the consumption rates. The consumption rate is defined as the proportional rate at which the current social significance of a marginal change in the level of per capita consumption declines with time. The commodity rate is the utility rate plus the product of the elasticity of the marginal utility of consumption and the rate of growth of per capita consumption. Assuming the utility rate of discount and the long run growth rate are constant, elasticity will be constant over time if the measurement scale is a constant elasticity utility function (also assumed). Then the consumption rate of discount will follow from observing the rate of growth of per capita consumption, specifying an appropriate utility function, and selecting an appropriate utility rate of discount. (Coyle-Wisconsin)
W78-02534

CONGESTION AND WILLINGNESS TO PAY: A STUDY OF BEACH USE,
Rhode Island Univ., Kingston. Dept. of Resource Economics.
K. E. McConnell.
Land Economics, Vol 53, No 2, p 185-195, May 1977. 3 tab, 19 ref.

Descriptors: *Beaches, *Recreation demand, *Recreation, *Rhode Island, Decision making, Demand, Estimating, *Beach management, *Congestion(Beaches), Site quality.

A model is developed for estimating demand for congested recreation sites in densely populated areas. The model is used to estimate benefit functions for six Rhode Island beaches, demonstrating a management strategy for short-run decisionmaking. This is done by comparing optimal beach use implied by benefit function with standards of beach use established by the Bureau of Outdoor Recreation plans for several states. In addition to providing insight into methodology for estimating effect of congestion, the study also suggests a technique which may be used to reexamine standards for beach usage. Reviewed at length is a 1974 survey of the Rhode Island beaches to determine willingness to pay. Willingness-to-pay interviews can have important policy implications. By setting different standards at different beaches, planners can increase the social value derived from these resources. And a policy of different standards at different beaches may imply greater available capacity than suggested by a mechanical use of Bureau of Recreation standards. (Coyle-Wisconsin)
W78-02556

ON THE PROFITABILITY OF EXHAUSTING NATURAL RESOURCES,
Department of Economics. Sweden, Umea Univ. (Sweden).
T. Puu.
Journal of Environmental Economics and Management, Vol 4, No 3, p 185-199, September 1977. 4 fig, 9 ref.

Descriptors: *Exploitation, *Investment, Fish, Economic efficiency, Benefits, *Mineral deposits, *Production.

The question is raised as to whether it is profitable from the point-of-view of an individual profit-maximizing firm to exhaust a natural resource completely. Two cases are examined. One deals with a mineral deposit of given size. The second deals with a growing biological substance, such as fish. The conclusions are described as fairly optimistic. Under the assumption of the model used, it never pays to exhaust a resource completely.

The assumptions are that any mineral deposit contains ore of every grade and that a biological substance continues to grow as long as a positive quantity of it is left. It is conceded that several important minerals occur in concentrated high-grade deposits only and that a certain minimum population of a species might be necessary for its survival. But it is considered worthwhile to analyze cases where increasing costs of working low grade ores or harvesting dispersed fish specimens always puts an end to exploitation before the resource is exhausted, unless prices rise beyond any limit. (Coyle-Wisconsin)
W78-02557

NONSEPARABILITY AND THE VOLUNTARY APPROACH TO EXTERNALITY PROBLEMS,
Dortmund Univ. (West Germany). Dept. of Economics.
A Endres.
Journal of Environmental Economics and Management, Vol 4, No 3, p 209-213, September 1977. 8 ref.

Descriptors: *Cost analysis, *Resource allocation, Optimization, Economics, *Externality problems, *Voluntary bargaining, *Polluter-pollutee bargaining.

Competitive markets fail to achieve optimal resource allocation when externalities exist. According to the voluntary approach to externality problems, this difficulty can be met by bargining between the externality producing firm and-in case of a negative externality, the injured firm, if property rights are clearly defined. Ronald Coase has held that, given zero transaction costs, a voluntary polluter-pollutee bargaining would result in an optimal resource allocation which is invariant to the liability rule. The contention has been challenged on several grounds, including the argument that liability matters when cost functions are nonseparable. It is a serious objection because separable externalities are not what would be expected to come across in practice. This paper argues that the challenge of the nonseparability critics, notably Marchand, Russell and Dick, suffers from important failures, correction of which will show the irrelevance of the separability question for the Coase theorem. It is contended that the Coase theorem can cope very well with the nonseparability criticism. There are problems for the theorem in income effects, long run effects, impounderabilities of bilateral monopoly and ubiquitous transaction costs. But they are not dealt with in this paper. (Coyle-Wisconsin)
W78-02558

A STATUS GROUP DYNAMICS APPROACH TO PREDICTING PARTICIPATION RATES IN REGIONAL RECREATION DEMAND STUDIES,
Wisconsin Univ.-Green Bay. Leisuer Sciences and Sociology.
P. C. West.
Land Economics, Vol 53, No 2, p 196-211, May 1977. 7 tab, 21 ref.

Descriptors: *Recreation demand, *Planning, *Methodology, *Social aspects, Social values, Social function, Social participation, *Status group dynamics, *Participation rates, Leisure lifestyle, Recreation participation rate stability.

A status group dynamics approach is developed as a first step in a more accurate projection of recreation demand. The basic premise is that recreation participation correlates to socioeconomic characteristics such as education partly because leisure lifestyles are important symbolic cues in the status-ordering reflected in the various socioeconomic indicators. Four ideal type concepts are developed--status-based diffusion, status-based withdrawal, status defusion and status group barriers. Status-based diffusion is associated with rapid faddish increases in participation rates. Status-based withdrawal is associated with declining participation rates. Status group barriers and status defusion are associated with relatively stable participation rates. The approach is labeled theoretical, conceptualizing dynamics of the effect of status forces on recreation participation rate stability and change. While it is noted that further research and refinement is needed, the approach is considered an aid in improving ability to deal with fad and fashion in recreation demand projections. (Coyle-Wisconsin)
W78-02561

COASTAL BELT TOURISM, ECONOMIC DEVELOPMENT AND ENVIRONMENTAL IMPACT,
A. Haulot, N. Vanhove, L. R. A. Verheyden, and R. H. Charlier.
International Journal of Environmental Studies, Vol 10, No 3, p 161-172, 1977. 13 fig, 6 tab, 11 ref.

Descriptors: *Seashores, *Tourism, *Water pollution, Industrial plants, Human population, Sea walls, Dunes, Recreation demand, Recreation facilities, Parks, Environmental effects, Coasts, *Belgium.

The natural environment of the Belgian coastline, a prime tourist attraction, characterized by fine sand beaches and dunes, and under Gulf Stream influence with less rain than inland and greater sunshine and wind intensity, is coming under great stress due to the modern tourist explosion. Along with the effects of fast moving technical and economic development, tourism may damage the better part of the amenities for which it exists. The environment has been affected by population growth and changes and additional pollution caused by the tourist influx, formerly confined to two or three months but now spread over the year. Analysis shows that the coastal area is reaching the saturation point at normal periods of occupancy and will soon be oversaturated at peak periods. Efforts are being made to prevent an unbroken line of buildings along the coastline through development of recreational tourist parks, geared to tourism and particularly to long-stay visitors. It is noted that there has been a turning point in government decisions on tourist development policy, including a decision that compensatory or parallel credits may be spent on touristic schemes. (Coyle-Wisconsin)
W78-02564

ESTIMATING THE BENEFITS OF RECREATION UNDER CONDITIONS OF CONGESTION,
Virginia Commonwealth Univ., Richmond. Dept. of Economics.
J. N. Wetzel.
Journal of Environmental Economics and Management, Vol 4, No 3, p 239-246, September, 1977. 2 fig, 2 tab, 12 ref.

Descriptors: *Natural resources, *Mathematical models, *Recreation demand, Cost-benefit analysis, Benefits, Measurements, Model studies, Recreation, Value, *Congestion, Travel cost method, Clawson method.

A challenge has been made against the use of the travel cost method to evaluate demand for outdoor recreation, holding that the method does not take into account problems raised by congestion. It is argued that the travel cost method will always underestimate the true benefits provided by recreation at a site because of the role of congestion, identifies what is called a source of bias in measuring benefits of outdoor recreation and suggests how it may be corrected. A congestion model is proposed which implies that recreation areas that have relatively low levels of use might have a higher overall economic value than similar areas with higher levels of use because of the differences in congestion at the sites. It is also suggested that building, developing, or increasing access to areas with low levels of use may lead to increased use but with a lower economic value attached to that use because of increased congestion. Such issues, it is noted, may be of considerable importance for projects such as reservoirs which are replacing low-attendance, high-value facilities by high-attendance, low-value facilities. The paper holds that higher value attached to the more primitive types of facilities is related not only to the physical differences but also due to a lower level of congestion. (Coyle-Wisconsin)
W78-02565

THE CHANGING CONTEXT OF WATER RESOURCES PLANNING: THE NEXT 25 YEARS,
Victoria Univ. (British Columbia). Dept. of Geography.
W. R. D. Sewell.
Natural Resources Journal, Vol 16, No 4, p 791-805, October 1976. 2 fig.

Descriptors: *Long-term planning, *Water resources development, *Water management(Applied), Social values, Planning, Institutional constraints, Social needs, Political constraints, Foreign countries, Technology, Model studies.

The implications of water resources planning for the next 25 years, in the context of a changing international society, are explored. A simple heuristic model of the social environment within which water resources planning takes place, is described. And a number of emerging concepts in water resources planning in the past half century are discussed and related to various social environments. The article holds that the picture that emerges is one of gradual improvement in water management in countries where planners have been able to successfully blend needs with technological innovation and the modification of institutions. But in other areas there are growing discrepancies between needs and technology, or needs and institutional adjustment. The result is that problems in many parts of the world have become gradually worse, reaching crisis proportions in some instances. Planning has either failed or has been unable to perform the role expected of it. It is concluded that while water resources planning has made major advances in the last half century, the challenges in the next quarter century will be even more demanding. A shift in perspective and improvements in techniques of analysis will be required if the challenges are to be met. (Coyle-Wisconsin)
W78-02567

CONTROLLING NONPOINT SEDIMENT SOURCES WITH CROPLAND MANAGEMENT: A NATIONAL ECONOMIC ASSESSMENT,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 5G.
W78-02568

CITIZEN PARTICIPATION IN THE YORK RIVER BASIN STUDY: THE USE OF THE VALUE TRADE-OFF QUESTIONNAIRE,
Weston (Roy F.), Inc., Roslyn, NY.
For primary bibliographic entry see Field 5G.
W78-02569

ENVIRONMENTAL QUALITY EFFECTS ASSOCIATED WITH SEASONAL HOME COMMUNITIES,
Pennsylvania Agricultural Experiment Station, University Park.
H. B. Gamble, G. L. Cole, M. I. Bevins, D. Derr, and D. M. Tobey.
Bulletin 801, Pennsylvania State University, July 1975. 81 p. 6 fig, 29 tab, 6 ref, 3 append. USDA Regional Research Project NE-65.

Descriptors: *Social aspects, *Water quality, *Property values, *Tax revenues, *Northeast U.S., Septic tanks, Land use, Non-structural alternatives, *Seasonal communities, *Environmental quality, *Lakeside communities, *Public opinion surveys, Rural environment, Set back, Community design.

A study was made of 18 seasonal home communities in five northeastern states to determine local attitudes toward environmental quality of the communities and to evaluate costs and benefits tied to different seasonal home environments. The study was also aimed at producing alternative institutional arrangements to improve efficient resource use in such communities. Residents completed detailed questionnaires covering attitudes toward environmental situations as well as demographic and socioeconomic data. Total costs of lower environmental standards for the average property, considering all the communities, was about $6,250. It is concluded that some control over actions of residents and how they use their land must be exercised. It was also concluded that, based on resident reactions to restrictions, legislative bodies need not fear adverse reactions to controls on land use and some activities. A significant tie was found between property values and environmental quality, showing there can be a dollar payoff in maintaining quality. It is recommended that attention be paid to proper handling of domestic wastes and that there be a minimum setback of buildings from the water and control of shore structures. (Coyle-Wisconsin)
W78-02570

AN OPERATIONAL APPROACH TO MULTIPLE OBJECTIVE DECISION MAKING FOR PUBLIC WATER RESOURCES PROJECTS USING INTEGER GOAL PROGRAMMING,
North Carolina Univ. at Greensboro. Dept. of Business Administration.
For primary bibliographic entry see Field 6A.
W78-02575

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

EFFICIENCY IMPACTS OF COST SHARING ON SHORELINE MANAGEMENT,
National Bureau of Standards, Washington, DC.
H. E. Marshall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 960, Price codes: A02 in paper copy, A01 in microfiche. Coastal Zone Management Journal, Vol. 2, No. 4, p 369-382, 1976. 3 tab, 26 ref.

Descriptors: *Cost sharing, *Beach erosion, *Hurricanes, *Flood protection, *Shore protection, Wind erosion, Waves(Water), Coasts, Coastal engineering, Costs, Efficiencies, Planning, Shoreline management, Corps of Engineers.

Federal cost-sharing programs for beach erosion control, coastal hurricane flood protection, and emergency coastal flood protection involving the U.S. Army Corps of Engineers are evaluated. Inconsistencies in the present system are shown to bias local planners in favor of excessively large and costly engineering projects rather than management protection techniques. these inconsistencies include: (1) the beach erosion program requires public ownership, whereas private interests may participate in the hurricane and emergency protection programs; (2) percentage costs borne by the federal government vary widely among the three programs, favoring hurricane protection and higher cost projects; (3) emergency protection is for repair of existing structures, while the other two programs for new projects; and (4) traditionally there has been no federal cost-sharing assistance to nonfederal interests for providing management techniques for shoreline protection. Operation and management costs are absorbed by local interests, while federal funds pay for a large proportion of construction costs (especially for hurricane and emergency protection) and, in the case of hurricane protection, land costs. Therefore planners are induced to select engineering rather than management projects, and to favor hurricane protection over beach erosion control. To encourage selection of optimum techniques for shoreline management, the non-federal cost share should be equalized for all techniques and cost categories. (Lynch-Wisconsin)
W78-02208

THE ALLOCATION OF A NATURAL RESOURCE WHEN THE COST OF A SUBSTITUTE IS UNCERTAIN,
Ohio State Univ., Columbus.
For primary bibliographic entry see Field 6B.
W78-02209

MONEY WAGES, PRICE OF NONTRADABLE GOODS, AND THE ENVIRONMENTAL GOODS,
Haifa Univ. (Israel). Dept. of Economics.
O. Israeli.
Journal of Environmental Economics and Management, Vol. 4, No. 3, September 1977, p. 265-270. 1 tab, 11 ref.

Descriptors: *Equilibrium prices, *Economics, Wages, Monetary benefits, Supply, *Environmental goods, *Tradable good, *Nontradable good, Full income, Supply elasticity.

The effect of environmental goods on money wages and the price of nontradable goods is analyzed. Environmental goods have two components. One is a public good, such as climate, terrain, view, and air quality. The second component is a private good, such as air conditioners and safety facilities. Environmental goods are treated as regular goods and are added to the two other composite goods--goods tradable between cities and goods not tradable, such as housing and transportation, which are typically used as components of the utility function. The relevant amount of environmental goods consists of that which the individual might purchase in the market. The analysis demonstrates that an equilibrium situation will prevail if either the money wage or the price of the nontradable good, or both, are a function of the given amount of environment goods. During equilibrium, people are indifferent with regard to their choice of location since their full income-defined as the money wage plus the money value of a given amount of environmental goods available free, is the same. (Coyle-Wisconsin)
W78-02210

OPTIMAL LOCATION OF A POLLUTING PLANT ON A LINE UNDER UNCERTAINTY,
Bar Ilan Univ., Rama-Gan (Israel). Dept. of Economics.
For primary bibliographic entry see Field 5G.
W78-02211

DIVIDING OCEAN RESOURCES: A DEVELOPMENT AND APPLICATION OF THE THEORY OF FACTOR TRANSFER,
University of Western Ontario, London.
J. R. Markusen.
Economic Record, Vol 52, No 138, p. 213-227, June, 1976. 15 ref.

Descriptors: *Economic efficiency, *Resource allocation, *Oceans, Mathematical models, Economics, Analytical techniques, Tariff, Foreign trade, Income, *Factor transfer.

As deep water petroleum production and the mining of ocean floor mineral resources become increasingly pratical, issues of efficiency in resource division vs. equity are raised. This paper argues that if a division of resource stocks is efficient, then, together with transfer payments, all countries will be better off relative to any inefficient division. A simple trade model for one-period, two-commodities and two-countries is developed. It is assumed that: (1) a resources is to be divided between the two countries, (2) that it will all be consumed in the present period, (3) that there will be no subsequent production externalities between the two countries. The paper examines how different divisions of the resource affect national and world real income. In general, if a division exists which increases world income relative to some initial resource distribution, there usually exists a transfer payment which will make both countries better off. It is concluded that geographic divisions are inefficient, whether they are arbitrary (e.g., 200 mi limits) or negotiated. Allocations by bidding, on the other hand, may be efficient in special circumstances. Adding revenue sharing payments to an agreement for an arbitrary geographic division may result in an even more inefficient solution. (Lynch-Wisconsin)
W78-02212

A CRITIQUE OF THE NATIONAL WATER COMMISSION ANALYSIS OF COST SHARING,
Cornell Univ. Agricultural Experiment Station, Ithaca, NY. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6B.
W78-02214

COST-EFFECTIVE ELECTRIC POWER GENERATION FROM THE WIND: A SYSTEM LINKING WINDPOWER WITH HYDROELECTRIC STORAGE AND LONG-DISTANCE TRANSMISSION,
Bureau of Reclamation, Denver, CO. Div. of Atmospheric Water Resources Management.
For primary bibliographic entry see Field 8C.
W78-02273

ECONOMIC ANALYSIS OF GEOTHERMAL ENERGY,
Battelle-Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 3E.
W78-02285

A SOCIAL AND ECONOMIC IMPACT STUDY OF OFFSHORE PETROLEUM AND NATURAL GAS DEVELOPMENT IN ALASKA. PHASE II.
Mathematical Sciences Northwest, Inc., Bellevue, WA.
For primary bibliographic entry see Field 5G.
W78-02517

ECONOMIC AND FINANCIAL IMPACTS OF FEDERAL AIR AND WATER POLLUTION CONTROLS ON THE ELECTRIC UTILITY INDUSTRY.
Temple, Barker and Sloane, Inc., Wellesley Hills, MA.
For primary bibliographic entry see Field 5G.
W78-02518

CHOOSING THE OPTIMUM FINANCIAL STRATEGY FOR POLLUTION CONTROL INVESTMENTS.
Environmental Protection Agency, Cincinnati, Ohio. Office of Technology Transfer.
For primary bibliographic entry see Field 5G.
W78-02519

INTERTEMPORAL AND INTERGENERATIONAL PARETO EFFICIENCY: A COMMENT,
Wisconsin Univ.-Madison. Dept. of Agricultural Economics.
R. C. Bishop.
Journal of Environmental Economics and Management, Vol 4, No 3, p 247-251, 1977. 4 ref.

Descriptors: *Discount rate, Optimization, Economics, *Pareto efficiency, Perfect competition, Fixed resources.

The earlier argument of Sandler and Smith that discounting at a constant rate for all individuals and time periods is Pareto inefficient over time is challenged. It is held that while Sandler and Smith's analysis of the Pareto conditions appear to be technically correct, they have erred in drawing such a conclusion. The counter argument is that to take an optimality condition and try to introduce a discount rate into it is meaningless. If the governmental sector is contemplating a project to produce a public good, it would clearly be necessary to discount consumers' willingness to pay if the project is to be evaluated in such a way as to achieve optimality. From the standpoint of Pareto efficiency this conclusion would not be changed by introducing multiple generations. The role of the discount rate as an expression of opportunity cost means that so long as all the other assumptions remain intact, any departure from the maximization conditions for individual producing and consuming units will lead to nonoptimality. (Coyle-Wisconsin)
W78-02522

HOW TO ESTIMATE THE SOCIAL RATE OF DISCOUNT,
Harvard Univ., Cambridge, MA.
For primary bibliographic entry see Field 6B.
W78-02534

CONGESTION AND WILLINGNESS TO PAY: A STUDY OF BEACH USE,
Rhode Island Univ., Kingston. Dept. of Resource Economics.
For primary bibliographic entry see Field 6B.
W78-02556

NONSEPARABILITY AND THE VOLUNTARY APPROACH TO EXTERNALITY PROBLEMS,
Dortmund Univ. (West Germany). Dept. of Economics.
For primary bibliographic entry see Field 6B.
W78-02558

ENVIRONMENT--EXTERNALIZING THE INTERNALITIES,
City Univ. of New York. Graduate School and Univ. Center.
For primary bibliographic entry see Field 5G.
W78-02560

TECHNOLOGICAL ECONOMICS APPLIED TO WASTE RECOVERY AND TREATMENT PROCESSES,
Aston Univ., Birmingham (England). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5D.
W78-02563

LOCAL VERSUS NATIONAL POLLUTION CONTROL: NOTE,
Clarkson Coll. of Technology. Potsdam, NY. Dept. of Economics.
For primary bibliographic entry see Field 5G.
W78-02566

STATUS, PROBLEMS, ADVANCES AND ECONOMICS OF EUCHEUMA FARMS,
For primary bibliographic entry see Field 4A.
W78-02571

INFLUENCE OF METERING, PRICING, POLICIES AND INCENTIVES ON WATER USE EFFICIENCY,
New South Wales Univ., Kensington (Australia). School of Economics.
For primary bibliographic entry see Field 6D.
W78-02572

6D. Water Demand

IMPROVED DESIGN AND OPERATING CRITERIA FOR RURAL WATER DISTRICTS (PHASE II),
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
J. E. Garton, and R. C. Peralta.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 647, Price codes: A03 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Stillwater, Completion Report, (1977). 28 p, 17 fig, 6 tab, 8 ref. OWRT B-034-OKLA(1).

Descriptors: *Water demand, *Water supply systems, *Distribution systems, *Rural areas, Standpipes, Water delivery, *Oklahoma, Water districts, *Rural water districts, Rural water systems, Peak demand rate, Daily demand rate, Monthly demand rate.

Rural Water District design depends on expected usage amounts and rates, which in rural areas, is often season-dependent. An 'average' rural water district in Oklahoma was monitored for consumptive use, peak use rates, and temporal distribution of water use. Monthly usage amounts per tap were significantly higher for June, July and August than for the rest of the year. (12,799 gal. or 48,431 l versus 8,219 gal. or 31,101 l). The average monthly use per residential tap was 8,258 gal. (31,248 l) and the average monthly use per person was 2,796 gal. (10,501 l). The period of time when water use was lowest from 11:00pm-6:30am. The criterion of 85% adequacy was used in presenting the following information. (Only 15% of the daily demands or daily peak flow rates exceeded these values). The daily demand per tap in July-August was 620 gal. (2,346 l) as compared with 365 gal. (1,381 l) for the other months. The peak demand values were .74 gpm (2.8 lpm) per person and 1.3 (4.9 lpm) per tap. (See also W75-11056)
W78-02206

WATER SUPPLY, LAND USE, AND URBAN GROWTH,
Santa Clara Valley Water District, CA.
For primary bibliographic entry see Field 4A.
W78-02448

INFLUENCE OF METERING, PRICING, POLICIES AND INCENTIVES ON WATER USE EFFICIENCY,
New South Wales Univ., Kensington (Australia). School of Economics.
A. R. Gallager, and R. W. Robinson.
Australian Water Resources Council, Canberra, Technical Paper No. 19, 1977. 28 fig, 50 tab, 151 ref, 1 append. 72/42.

Descriptors: Water supply, *Pricing, *Water demand, *Water rates, Water users, Costs, Water policy, Economics, Potable water, Elasticity of demand, Cities, *Australia, Metering, Incentives.

The price of water for urban use is the focus of this research report on the urban water supply industry in Australia. The hypothesis that the price elasticity of demand for water is zero is rejected; it is contended that, although elasticity is small, over the long-run responsiveness of water use to price would result in changed demand habits. As consumers are made aware of water supply costs, resources would not need to be wasted on excessively large water supply systems. Such needlessly large systems often result from the conventional approach to estimating future water requirements through extrapolation from past consumption trends, together with the rating system used by most water authorities (based on property valuation). The installation of water meters permits a water authority to set water allowances and detect excess users. Water allocation policies are improved, thereby generating greater water use efficiency. An alternative approach, however, is to replace water requirement with the urban water demand function, in which the quantity of water demanded per unit of time is determined by the price per unit of water, other commodity prices, income, and tastes. The economies of density and diseconomies of distance must also be considered. The price should reflect the higher cost of providing water to customers located further from the load center, thus discouraging urban sprawl and encouraging concentration of water users. (Lynch-Wisconsin)
W78-02572

6E. Water Law and Institutions

WATER POLICIES IN INDIA AND CHINA,
Scandinavian Inst. of Asian Studies, Copenhagen (Denmark).
J. Sigurdson.
AMBIO, Vol 6, No 1, p. 70-76, 1977. 1 fig, 2 tab, 21 ref.

Descriptors: *Water policy, *Water resources, Administration, Governments, Irrigation, Flood control, Agriculture, Foreign countries, *China, *India, Tubewell irrigation.

India and China are compared in terms of water resources, land area, precipitation, runoff, cultivated area, grain production, and population in the first section of this article. In the second, water and development strategies are contrasted. Both countries are well-endowed with water resources, but precipitation shows extreme spatial and temporal variations. Irrigation and flood control have been central to planning in each country. China has maintained a strong central control of water resources; in India the constituent states have been given the responsibility for planning and implementing their own water programs. In water conservation policy, China now emphasizes (1) small projects, (2) irrigation and drainage systems complete with supplementary facilities, and (3) projects undertaken by the people's communes and their production brigades and teams. The latter has facilitated a more intensive farming than otherwise would have been possible. The present irrigation system in India has been designed more for protection against erratic rainfall than for intensive farming. Tubewell irrigation has been rapidly introduced in recent years in India and China, totalling about 2.6 million and 2.0 million respectively. (Lynch-Wisconsin)
W78-02213

A CRITIQUE OF THE NATIONAL WATER COMMISSION ANALYSIS OF COST SHARING,
Cornell Univ. Agricultural Experiment Station, Ithaca, NY. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6B.
W78-02214

WATER POLLUTION LAW: CONGRESS CONCEDES SOME 'MID-COURSE CORRECTIONS'.
Industry Week, Vol. 195, No. 4, p 17-19, November 21, 1977.

Descriptors: *Water pollution control, *Legislation, Industries, Toxins, Pollutants, Steel, *Industrial wastes, Legal aspects, *Water Pollution Control Act(1972), *Metal finishing industry.

A common theme echoed for the half decade since the passage of the 1972 water pollution control law that 'mid-course corrections' would have to be made to fashion something industry could live with, particularly regarding the strict technology-forcing 1983 requirements. On November 10, 1977, a House-Senate conference committee completed work on those mid-course corrections

and drew both praise and blame from industry spokesmen for their efforts. Postponement of the best available technology (BAT) requirement from 1983 to 1984 is hailed by some as a true compromise. BAT control will still be required for 'toxic' pollutants, but not necessarily for 'conventional' pollutants such as oxygen-consuming materials or suspended solids. Nonetheless, requirements for eliminating discharge of toxins to waterways and municipal sewer systems may force a number of marginally profitable small plants out of business, particularly in the metal finishing industry. No special relief from environmetal regulation was granted the steel industry, which has hoped for favorable treatment in light of its current financial problems. (Eberle-NWWA)
W78-02292

THE ARIZONA WATER RESOURCES COMMITTEE: HISTORY AND POLITICS,
Arizona Univ., Tucson. School of Renewable Natural Resources.
H. J. Cortner, and M. P. Berry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 799, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, November 1977. 6 p. OWRT A-072-ARIZ(3), 14-34-0001-7005 and 7006.

Descriptors: Water yield improvement, *Arizona, *Decision-making, Watershed management, *History, *Political aspects, *Arizona Water Resources Committee, Political interest groups, Vegetative modification.

The Arizona Water Resources Committee (AWRC) was examined from both an historical and political perspective. The AWRC, formed in 1956, is a political interest group which predominately seeks to increase the water yield from Arizona's watersheds through vegetative modification. The study traced the history of the activities of the AWRC since its formation, and evaluated the committee's success in advancing its principal goals and objectives in the policy process. As an organized group, the AWRC is characterized by many of the variables that distinguish groups with maximum potential to gain access and exert influence in decision-making. Committee activities in securing congressional appropriations, in building a network of cooperative relations among agencies and researchers, in convincing resource managers of the efficacy of watershed management research, and in obtaining political and financial support for those endeavors demonstrate the AWRC's ability to capitalize upon its access and influence potential. While the committee has yet to see its goal of a full-scale operational program of water yield improvement realized, its remarkable success in supporting and sponsoring watershed research programs are indications of its political proficiency.
W78-02400

INTERTEMPORAL AND INTERGENERATIONAL PARETO EFFICIENCY: A COMMENT,
Wisconsin Univ.-Madison. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6C.
W78-02522

DEEP WELL INJECTION OF INDUSTRIAL WASTES: GOVERNMENT CONTROLS AND LEGAL CONSTRAINTS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 5G.
W78-02538

THE CHANGING CONTEXT OF WATER RESOURCES PLANNING: THE NEXT 25 YEARS,
Victoria Univ. (British Columbia). Dept. of Geography.
For primary bibliographic entry see Field 6B.
W78-02567

HARMONIZING WATER RESOURCES DEVELOPMENT AND USE WITH ENVIRONMENTAL PROTECTION IN MUNICIPAL AND INTERNATIONAL LAW,
Fordham Univ., NY. School of Law.
L. A. Teclaff.
Natural Resources Journal, Vol. 16, No. 4, p 807-861, October 1976.

Descriptors: *Legal aspects, *Water resources development, *Environmental effects, *Water law, History, Treaties, Judicial decisions, International law, Riparian waters, Legislation, Municipal law.

Phases in the evolution of municipal and international water law in relation to environmental protection are traced and analyzed. In municipal law, three periods are distinguished: (1) before about 1850 any environmental protection attributed to water law was an incidental by-product of legal restraints on water resource development; (2) a period of unbridled water resource development began in the second half of the 19th century without regard for environmental consequences; (3) beginning in the mid-1960's water law has been slowly reshaped to reflect the perception that changes in one environmental element must be harmonized with effects on all other elements. Each phase is discussed in detail. International water law similarly was long concerned only with protection of water uses and interests, and environmental benefits were incidental. The scope of treaties grew with the increasing need for cooperation and the capacity for inflicting injury. As the manace of water pollution increased, distribution rules were supplemented by rules protecting water resources of neighboring states. In the 20th century pollution control efforts were broadened, as in the U.S.-Canada joint commission on Great Lakes pollution beginning in 1912. Recent developments are discussed. In the United States the river basin authority is giving way to multipurpose resource agencies in regulating general resource development. (Lynch-Wisconsin)
W78-02573

THERMOMETRY IN THE CONTROL OF WATER QUALITY,
National Bureau of Standards, Washington, DC.
For primary bibliographic entry see Field 5A.
W78-02618

PUGET SOUND POWER AND LIGHT CO. V. F.P.C. (LICENSING JURISDICTION OVER REPAIRS TO HYDROELECTRIC PROJECT).
557 F.2d 1311-16 (9th Cir. 1977).

Descriptors: *Federal jurisdiction, *Federal power act, *Hydroelectric plants, *Hydroelectric project licensing, *Repairing, Construction, Dam construction, Diversion dams, Electric generators, Electric power, Electric power industry, Electric power production, Electric power plants, Generators, Hydroelectric power, Jurisdiction, Legislation, Non-navigable waters, Power system operation, Projects, Regulation, Rivers, Judicial decisions.

Petitioner, electric power company, sought a determination that respondent, Federal Power Commission, had no licensing jurisdiction over a hydroelectric project originally built in 1904 on a non-navigable stream. The project had undergone extensive repair and restoration following a landslide in 1936. The Commission contended that such repairs were sufficient to bring the project within its jurisdiction under the provisions of the 1935 amendments to the Federal Power Act. Those amendments required parties intending to construct dams or other projects on non-navigable streams to file a license application with the Commission. The Ninth Circuit Court of Appeals held that the mandatory licensing requirements of the Federal Power Act were not to be applied retroactively. Furthermore, the court held that the repair work undertaken by the petitioner did not constitute construction within the meaning of the 1935 amendments. Although the repairs involved were substantial, they merely restored the project to its original specifications with no changes in capacity or physical plants. (White-Florida)
W78-02928

6F. Nonstructural Alternatives

AN ANALYSIS OF THE EFFECTIVENESS OF LAND USE REGULATIONS REQUIRED FOR FLOOD INSURANCE ELIGIBILITY,
Mississippi State Univ., Mississippi State. Div. of Business Research.
L. R. Cheatham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 596, Price codes: A06 in paper copy, A01 in microfiche. Mississippi State University, Water Resources Research Institute, Completion Report, October 1977. 113 p, 6 fig, 32 tab, 23 ref. OWRT A-105-MISS(1), 14-34-0001-7052.

Descriptors: Flood plains, *Insurance, *Zoning, *Regulation, *Land use, *Flood plain insurance, *Legislation, Construction, Non-structural alternatives, *Mississippi, Flood control, *National Flood Insurance Program, Federal Insurance Administration.

The study was designed to investigate the effectiveness of land use control measures by the Federal Insurance Administration (FIA) for participation in the National Flood Insurance Program. Limitations in FIA authority are primarily associated with the emergency program of insurance. All communities entering the flood insurance program eventually will be required to adopt and implement appropriate land use control measures. Investigations were conducted for selected Mississippi municipalities to determine if status C land use regulations, required in community flood plain ordinances, were being enforced. Evidently, communities in the state are actively enforcing such ordinances. Analyses of construction trends revealed that flood plain ordinances have had an effect on the amount of flood plain construction in selected Mississippi regular program communities. When construction data for two communities were separated into commercial and non-commercial categories, it became apparent that the two types of construction were not affected equally by flood plain ordinances. The amount of construction on flood plans was influenced by changes in the business cycle and by the occurrence of major floods.
W78-02207

FLOOD PLAIN INFORMATION: LITTLE CREEK, PRINCE WILLIAM COUNTY, VA,
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 4A.
W78-02623

FLOOD PLAIN INFORMATION: MILL RUN, BLAIR COUNTY, PENNSYLVANIA.
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 4A.
W78-02624

FLOOD PLAIN INFORMATION: LUZERNE COUNTY, PENNSYLVANIA, SUSQUEHANNA AND LACKAWANNA RIVERS.
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 4A.
W78-02627

FLOOD HAZARD INFORMATION: CHAMBERS CREEK, EVERMAN, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 4A.
W78-02628

FLOOD PLAIN INFORMATION: CIENEGAS CREEK AND CANTU BRANCH, DEL RIO, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 4A.
W78-02629

FLOOD PLAIN INFORMATION: MARYS AND SOUTH MARYS CREEKS, FORT WORTH, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 4A.
W78-02630

FLOOD PLAIN INFORMATION: MONAHANS DRAW, ODESSA, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 4A.
W78-02631

SPECIAL FLOOD HAZARD INFORMATION: WALNUT BRANCH, SEGUIN, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 4A.
W78-02632

FLOOD PLAIN INFORMATION: CRUMP CREEK, HANOVER COUNTY, VIRGINIA.
Army Engineer District, Norfolk, VA.
For primary bibliographic entry see Field 4A.
W78-02633

FLOOD PLAIN INFORMATION: JAMES RIVER AT RICHMOND, VA.
Army Engineer District, Norfolk, VA.
For primary bibliographic entry see Field 4A.
W78-02634

FLOOD PLAIN INFORMATION: MECHUMPS CREEK, HANOVER COUNTY, VA.
Army Engineer District, Norfolk, VA.
For primary bibliographic entry see Field 4A.
W78-02635

FLOOD PLAIN INFORMATION: SWIFT CREEK, CHESTERFIELD COUNTY, VA.
Army Engineer District, Norfolk, VA.
For primary bibliographic entry see Field 4A.
W78-02636

FLOOD PLAIN INFORMATION: TOTOPOTOMOY CREEK, HANOVER COUNTY, VA.
Army Engineer District, Norfolk, VA.
For primary bibliographic entry see Field 4A.
W78-02637

FLOOD PLAIN INFORMATION: MONONGAHELA RIVER, CARROLL TOWNSHIP, DONORA, AND FALLOWFIELD TOWNSHIP, WASHINGTON COUNTY, PENNSYLVANIA.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 4A.
W78-02638

FLOOD PLAIN INFORMATION: MONONGAHELA RIVER, CENTERVILLE BOROUGH AND EAST BETHLEHEM TOWNSHIP, WASHINGTON COUNTY, PA.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 4A.
W78-02639

FLOOD PLAIN INFORMATION: MONONGAHELA RIVER, FAYETTE COUNTY, PENNSYLVANIA.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 4A.
W78-02640

FLOOD PLAIN INFORMATION: MONONGAHELA RIVER, MONESSEN AND ROSTRAVER TOWNSHIP, WESTMORELAND COUNTY, PENNSYLVANIA.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 4A.
W78-02641

FLOOD PLAIN INFORMATION: MONONGAHELA RIVER, UNION TOWNSHIP, NEW EAGLE, AND MONONGAHELA, WASHINGTON COUNTY, PA.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 4A.
W78-02642

FLOOD PLAIN INFORMATION: NESHANNOCK CREEK BASIN, LAWRENCE COUNTY, PENNSYLVANIA--MAIN REPORT AND TECHNICAL APPENDIX.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 4A.
W78-02643

FLOOD PLAIN INFORMATION: OHIO AND BEAVER RIVERS, BEAVER COUNTY, PENNSYLVANIA.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 4A.
W78-02644

6G. Ecologic Impact Of Water Development

SOME ECONOMIC AND ENVIRONMENTAL EFFECTS OF HIGHWAYS IN JAPAN AND THE UNITED STATES,
Federal Highway Administration, Washington, D.C. Transportation Economics Div.
For primary bibliographic entry see Field 5C.
W78-02221

ECONOMIC/DEMOGRAPHIC ASSESSMENT MANUAL: CURRENT PRACTICES, PROCEDURAL RECOMMENDATIONS, AND A TEST CASE,
Arizona State Univ., Tempe. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W78-02274

BUREAU OF RECLAMATION, CONSTRUCTION WORKER SURVEY,
Arizona State Univ., Tempe. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W78-02275

CHANGES IN THE ECOLOGY OF AREAS ADJACENT TO IRRIGATION SYSTEMS, (IN RUSSIAN),
Kuban Agricultural Inst., Krasnodar (USSR).
For primary bibliographic entry see Field 3F.
W78-02388

USE OF ECOLOGICAL PROFILES IN THE STUDY ON THE DYNAMICS OF COASTAL LANDSCAPES, (IN RUSSIAN),
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 2L.
W78-02446

ENVIRONMENTAL PHOSPHORUS HANDBOOK.
For primary bibliographic entry see Field 5B.
W78-02457

COASTAL BELT TOURISM, ECONOMIC DEVELOPMENT AND ENVIRONMENTAL IMPACT,
For primary bibliographic entry see Field 6B.
W78-02564

ENVIRONMENTAL QUALITY EFFECTS ASSOCIATED WITH SEASONAL HOME COMMUNITIES,
Pennsylvania Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 6B.
W78-02570

HARMONIZING WATER RESOURCES DEVELOPMENT AND USE WITH ENVIRONMENTAL PROTECTION IN MUNICIPAL AND INTERNATIONAL LAW,
Fordham Univ., NY. School of Law.
For primary bibliographic entry see Field 6E.
W78-02573

MONITORING ENVIRONMENTAL IMPACTS OF THE COAL AND OIL SHALE INDUSTRIES RESEARCH AND DEVELOPMENT NEEDS,
Radian Corp., Austin, TX.
For primary bibliographic entry see Field 5A.
W78-02619

ENVIRONMENTAL, HEALTH, AND CONTROL ASPECTS OF COAL CONVERSION: AN INFORMATION OVERVIEW: VOLUMES 1 AND 2.
Oak Ridge National Lab., Oak Ridge, TN.
For primary bibliographic entry see Field 5C.
W78-02622

PROCEEDINGS OF THE NINTH DREDGING SEMINAR.
Texas A and M Univ., College Station. Center for Dredging Studies.
For primary bibliographic entry see Field 5C.
W78-02646

7. RESOURCES DATA

7A. Network Design

EVALUATION OF MILES CITY SWR-75 WEATHER RADAR,
South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
P. L. Smith, Jr.
Report No. 77-1, April 1977. 55 p, 6 fig, append. Submitted to Bureau of Reclamation, Denver, Colo., Div of Atmospheric Water Resources Mgmt. Bur Reclam Purchase Order 7-01-81-00478.

Descriptors: *Radar, *Evaluation, Weather modification, Weather data, *Montana, Measurement, Instrumentation, Calibration, Reflectivity, Errors, Miles City(Mont).

Results are presented of an evaluation of the SWR-75 C-band weather radar system located at Miles City, Montana. The evaluation procedures are described in some detail and the results of the measurements given. Where appropriate, recommendations for changes or improvements in the system and the calibration and operating procedures are presented. The SWR-75 system and the calibration procedures in use conform for the most part to currently accepted practice in the weather radar field. No basis was found for expecting substantial errors in C-band equivalent

radar reflectivity factors measured with the SWR-75.
W78-02227

DEVELOPMENT OF AN EXPERIMENTAL HYDROMETEOROLOGICAL DATA COLLECTION NETWORK,
Western Scientific Services, Inc., Fort Collins, CO.
For primary bibliographic entry see Field 2B.
W78-02228

DESIGN CONSIDERATIONS FOR SAMPLING PROGRAMS IN REMOTE AREAS,
Alaska Univ. College.
L. A. Casper, R. C. Gordon, and E. W. Mueller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-245 066, Price codes: A04 in paper copy, A01 in microfiche. EPA Artic Environmental Research Laboratory, College, Working Paper No. 23, November 1973. 57 p, 24 fig, 13 ref.

Descriptors: *Water sampling, *Polar regions, *Design criteria, *Testing procedures, *Sampling, *Arctic, *Alaska, Water quality, Data collections, Chemical analysis, Instrumentation, On-site tests, Testing, Water analysis, Aircraft, Analytical techniques, Reliability, Cold regions, Transportation, Preservation techniques.

Water quality field studies in the Arctic rapidly reveal flaws in logistic schemes and equipment reliability because of severe constraints placed on all components by the environment. Since the studies generally require collection of samples in areas remote from central laboratory facilities, the time lag between sampling and analysis necessitates the inclusion of field analyses in the sampling scheme where the analytes may exhibit rapid change. The selected scheme includes components of sampling, field processing, shipping, and laboratory analysis which are dependent of both the time and mode of transportation as well as the requirements for analytical reliability. Decisions regarding analytical specifications are dependent upon the resources of the investigator, although in a more immediate sense the decisions are a function of the working environment and available field instrumentation. Additional development and design is necessary to bring component reliability up to the state-of-the-art. Unit data cost and statistical reliability can be optimized through critical path analysis. Equipment reliability can be greatly improved through the application of environmental simulation techniques such as those developed for space program instrumentation. Research on analyte concentration for improved transportability and preservation could achieve a reduction in statistical and logistical restraints. (Henley-ISWS)
W78-02235

PROCEDURES FOR EVALUATING OPERATIONS OF WATER MONITORING NETWORKS,
URS Research Co., San Mateo, CA.
For primary bibliographic entry see Field 5A.
W78-02656

7B. Data Acquisition

A COMPARISON BETWEEN CONVENTIONAL AND LANDSAT-BASED HYDROLOGIC MODELING: THE FOUR MILE RUN CASE STUDY,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W78-02232

EXAMINATION OF THE ELUTRIATE TEST, A SCREENING PROCEDURE FOR DREDGING REGULATORY CRITERIA,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5A.
W78-02253

MULTICHANNEL SEISMIC REFLECTION PROFILES OF THE CONTINENTAL CRUST BENEATH THE NEWFOUNDLAND RIDGE,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia).
For primary bibliographic entry see Field 2L.
W78-02260

A MORE PRECISE METHOD OF DETERMINATION OF SPECIFIC RESISTANCE TO FILTRATION,
K. A. Wuhrmann.
Journal of the Institute of Water Pollution Control, Vol 76, No 3, p 377-378, 1977. 2 fig, 1 tab, 2 ref.

Descriptors: *Filtration, *Analytical techniques, *Filters, *Monitoring, *Instrumentation, Viscosity, Flow resistance, Flowmeters, Flow measurement, Automatic control, Equipment, Waste water treatment, Filtration resistance.

The method of determination of specific resistance to filtration of substances such as sewage sludge was refined with the design of an automatic device for filtrate sampling. The resistance to filtration is normally expressed as a function of the flow gradient of the filtrate calculated on the basis of the filtrate volume as a function of time, the filtering pressure, the active filtering area, the dry residue, and the dynamic viscosity of the liquid. The automatic resistance measuring device registers the time to obtain two predetermined volumes of filtrate from a standardized filtering apparatus. A comparison of results obtained from eight series of five conventional and five automatic measurements is presented. (Schulz-FIRL)
W78-02374

ASSESSMENT OF AQUATIC VEGETATION WITH SATELLITE-DERIVED DATA,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2H.
W78-02401

TECHNIQUE FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 4A.
W78-02416

METHODS FOR COLLECTION AND ANALYSIS OF AQUATIC BIOLOGICAL AND MICROBIOLOGICAL SAMPLES,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 5A.
W78-02432

TECHNIQUES FOR ESTIMATING FLOOD DISCHARGES FOR OKLAHOMA STREAMS,
Geological Survey, Reston, VA; and Oklahoma City, OK. Water Resources Div.
For primary bibliographic entry see Field 4A.
W78-02436

PHASE-SENSITIVE RADIO-ECHO SOUNDING AT THE DEVON ISLAND ICE CAP, CANADA,
Bristol Univ. (England). H. H. Wills Physics Lab.
For primary bibliographic entry see Field 2C.
W78-02581

AN ERROR IN ICE-TEMPERATURE MEASUREMENT,
British Antarctic Survey, Cambridge (England).
For primary bibliographic entry see Field 2C.
W78-02591

A COMPARISON OF THE CRREL 500 CU CM TUBE AND THE ILTS 200 AND 100 CU CM BOX CUTTERS USED FOR DETERMINING SNOW DENSITIES,
Colorado Univ., Boulder. Dept. of Geography; and Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
For primary bibliographic entry see Field 2C.
W78-02592

REMOTE SENSING REPORT, PACIFIC NORTHWEST AREA, WASHINGTON, OREGON, IDAHO, APRIL AND JULY 1973.
National Field Investigation Center, Denver, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 599, Price codes: A08 in paper copy, A01 in microfiche. Report No. EPA-330/3-74-002, September 1974. 146 p, 56 fig, 1 tab, 3 append.

Descriptors: *Remote sensing, *Water pollution sources, *Washington, *Oregon, *Idaho, Photography, Aerial photography, Infrared radiation, Aircraft, Water pollution, Rivers, Lakes, Estuaries, Oil spills, Wastes, Pulp wastes, Farm wastes, Feed lots, Industrial wastes, Cities, Effluents, Outlets, Water pollution control, Law enforcement, *Puget Sound(Wash), *Willamette River(Ore), *Snake River(Idaho), *Salmon River(Idaho), *Coeur D'Alene Lake(Idaho).

Airborne remote sensing studies of five areas in the Pacific Northwest states of Washington, Oregon, and Idaho were conducted in April and July 1973. Aircraft sensors were selected to record the presence and characteristics of municipal and industrial wastewater discharges. The location and characteristics of detected discharges were compared with those of known discharges reported in Refuse Act Permit Program (RAPP) and National Pollutant Discharge Elimination System (NPDES) permit applications. Discharges from unknown sources that may have originated fron nonfilers, and apparent additional or changed discharges at sources filing for permits were identified. The color, dispersion pattern, and size of visible plumes for the observed discharges were documented. (Sims-ISWS)
W78-02611

RETRANSMISSION OF HYDROMETRIC DATA IN CANADA,
Department of the Environment, Ottawa (Ontario). Applied Hydrology Div.
I. A. Reid, and R. A. Halliday.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-24674, Price codes: A02 in paper copy, A01 in microfiche. Quarterly Report No. SR 28190, April 1976. 8 p, 1 fig, 3 tab.

Descriptors: *Data collections, *Hydrologic data, *Data transmission, *Canada, Water levels, Precipitation(Atmospheric), Temperature, Air temperature, Meteorological data, Satellites(Artificial), Water resources, Flood forecasting, Remote sensing, Equipment, Projects, Hydrology, *LANDSAT data, *Data collection platforms, Retransmission.

Data Collection Platforms were installed at 18 sites in remote areas of Canada for transmittal of water level and other water resource data. The implementation of the Alaska Receive Site in December 1975 has increased the value of the system substantially. The near real-time data are used for water management purposes. The system has met all requirements and the suitability of satellite retransmission has been demonstrated. (See also W77-02506, W77-03111) (Sims-ISWS)

W78-02612

DEVELOPMENT OF A METHODOLOGY FOR DESIGNING CARBON MONOXIDE MONITORING NETWORKS,
Systems Applications, Inc., San Rafael, CA.
For primary bibliographic entry see Field 5A.
W78-02653

PRELIMINARY RESULTS OF UHF RADIOMETRIC AND DIRECT GROUND STUDIES OF SOIL MOISTURE IN 1975,
For primary bibliographic entry see Field 2G.
W78-02684

7C. Evaluation, Processing and Publication

A MULTI-PARAMETER WATER QUALITY MANAGEMENT MODEL FOR RIVER BASINS,
Cornell Univ., Ithaca, NY. Center for Environmental Research.
For primary bibliographic entry see Field 5G.
W78-02202

EVALUATION OF MILES CITY SWR-75 WEATHER RADAR,
South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
For primary bibliographic entry see Field 7A.
W78-02227

DEVELOPMENT OF AN EXPERIMENTAL HYDROMETEOROLOGICAL DATA COLLECTION NETWORK,
Western Scientific Services, Inc., Fort Collins, CO.
For primary bibliographic entry see Field 2B.
W78-02228

INVENTORY OF SEDIMENT SAMPLE COLLECTION STATIONS IN THE MISSISSIPPI RIVER BASIN,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Mobility and Environmental Systems Lab.
For primary bibliographic entry see Field 2J.
W78-02230

RADIUM-226, URANIUM, AND OTHER RADIOLOGICAL DATA COLLECTED FROM WATER QUALITY SURVEILLANCE STATIONS LOCATED IN THE COLORADO RIVER BASIN OF COLORADO, UTAH, NEW MEXICO, AND ARIZONA- JANUARY, 1961 THROUGH JUNE, 1972.
Environmental Protection Agency, Denver, CO. Surveillance and Analysis Div.
For primary bibliographic entry see Field 5A.
W78-02231

URBAN STORM RUNOFF INLET HYDROGRAPH STUDY: VOL. 1, COMPUTER ANALYSIS OF RUNOFF FROM URBAN HIGHWAY WATERSHEDS UNDER TIME-AND SPACE-VARYING RAINSTORMS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 4D.
W78-02240

DIGITAL LOAD CONTROL FOR HYDROELECTRIC POWERPLANTS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 8C.
W78-02266

FREQUENCY-RESPONSE ANALYSIS OF AUTOMATED CANALS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 8C.
W78-02271

URBAN STORM RUNOFF MODEL,
CH2M Hill, St. Louis, MD.
For primary bibliographic entry see Field 5B.
W78-02300

COMPUTERS AND INSTRUMENTATION--PARTNERS IN TREATMENT PLANT OPERATION,
R. Zucchetti.
Water and Pollution Control, Vol 115, No 8, p 9-11, August, 1977. 1 fig.

Descriptors: *Computers, *Automatic control, *Monitoring, *Data processing, *Instrumentation, Automation, Digital computers, Operation and maintenance, Water treatment, Waste water treatment.

The use of computers and instrumentation systems is considered for providing automatic control and operation monitoring in municipal water and waste water treatment. Topics discussed include the importance of primary sensing elements, data logging, digital control centers, microprocessors, and trouble-shooting. A typical wiring diagram for a microprocessor which can be used to monitor filters, headloss, turbidity, and flow rate is presented. Criteria which may be useful in the evaluation of a computerized monitoring system for plant operation are presented. (Schulz-FIRL)
W78-02373

COMPUTER CONTROL OF LARGE-SCALE WASTEWATER TREATMENT PLANT,
Tokyo Sewerage Bureau (Japan).
For primary bibliographic entry see Field 5D.
W78-02380

COMPUTER MODELING TO MAXIMIZE WATER USE EFFICIENCY AND REDUCE ENERGY IN IRRIGATION,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W78-02404

GROUND WATER FAVORABILITY AND SURFICIAL GEOLOGY OF THE PORTLAND AREA, MAINE,
Geological Survey, Augusta, ME. Water Resources Div.
G. C. Prescott, Jr.
Available from the U. S. Geological Survey, Reston, VA 22092, price $1.75. Hydrologic Investigations Atlas HA-561, 1976. 1 sheet, 6 fig, 15 ref.

Descriptors: *Groundwater resources, *Hydrogeology, *Aquifer characteristics, *Maine, Water wells, Water yield, Water resources development, Glacial drift, Groundwater availability, Water quality, Water levels, Groundwater recharge, Surface-groundwater relationships, Maps, *Portland area(Maine).

This hydrologic atlas describes the surficial geology and groundwater resources of about 240 square miles in Cumberland County, Maine. The most productive aquifers are outwash and ice-contact deposits. Their locations and the most favorable areas for obtaining large yields from them are indicated on the map. The largest reported yield from a well in unconsolidated deposits is 100 gpm, but it is likely that in places as much as 500 gpm can be obtained from properly located and developed wells. Ground water is available to drilled wells in bedrock in sufficient quantity for domestic use. The average yield from bedrock wells is 11 gpm, the median yield is 5 gpm, and the maximum reported yield is 150 gpm. The quality of the water is generally good, although brackish or salty water is obtained by some wells on the coast. (Woodard-USGS)
W78-02413

RECONNAISSANCE HYDROLOGY OF PORTAGE GLACIER BASIN, ALASKA--1972,
Geological Survey, Anchorage, AK. Water Resources Div.
L. R. Mayo, C. Zenone, and D. C. Trabant.
Available from the U. S. Geological Survey, Reston, VA 22092, price $1.25. Hydrologic Investigations Atlas HA-583, 1977. 2 sheets, 13 ref.

Descriptors: *Glaciers, *Glaciology, *Glacial drift, *Alaska, Climatology, Snow, Ice, Reviews, Evaluation, Hydrologic data, Projections, Snowmelt, Lakes, Ablation, Maps, Aerial photography, *Portage Glacier basin(Alaska), Calving, Glacier retreat, Outburst floods, Portage Lake.

Early reports of conditions in Portage Pass, Alaska, provide evidence that Portage Glacier was formerly larger and thicker. Past conditions, recent history, current retreat, and possible future changes are summarized from an analysis of reports, photographs of the glacier (1939, 1950, and annually since about 1960), and data on snow and ice balance and bathymetry (1972). Between 1900 and 1972, the glacier terminus retreated 3.4 kilometers, and the lower part of the glacier thinned 200 meters. Climatic change controlled the retreat until about 1930; since then deep water at the terminus has influenced the calving retreat. The calving rate and present terminus position cannot be sustained by current climatic conditions and rate of snow accumulation. Thus the glacier will continue to recede until the terminus stabilizes in shallower water, probably about 1.5 kilometers upvalley from the present terminus and in about year 2020, assuming no change in present climatic conditions and calving rate. Possible small climatic changes could cause a shift in the point at which annual snow accumulation equals annual ablation (500 meters) and a corresponding change in terminus behavior. Potential natural hazards include avalanches, outburst floods from ice-dammed lakes, and unstable icebergs. (Woodard-USGS)
W78-02414

WISCONSIN, A SUMMARY OF ACTIVITIES AND PLANS OF THE UNITED STATES DEPARTMENT OF THE INTERIOR, GEOLOGICAL SURVEY, 1977,
Geological Survey, Madison, WI. Water Resources Div.
J. H. Green, and R. A. Lansing.
Wisconsin District report, 1977. 102 p, 1 plate.

Descriptors: *Wisconsin, *Projects, *Water resources, *Geological surveys, *Land resources, Mineralogy, Water resources development, Hydrologic data, Floods, Sediment transport, Streamflow, Low flow, Groundwater resources, Aquifer characteristics, Water quality, Mapping, Publications, Bibliographies, Reviews.

The U.S. Department of the Interior's Geological Survey, established in 1879, is the Nation's principal fact-finding agency concerned with physical resources--the configuration and character of land surface, the composition and structure of the underlying rocks, and the quality, extent, and distribution of water and minerals. The Survey is an impartial fact-finding and research agency that gathers and interprets data so that managers can make decisions based on objective information. The Wisconsin program of the U.S. Geological Survey is, for the most part, planned and funded with local and State agencies through cooperative programs. This booklet will be useful to cooperat-

ing agencies by providing an understanding of all current studies and identifying present and future resource problems that are relevant to the experience and competence of the Survey in Wisconsin. (Woodard-USGS)
W78-02415

WATER RESOURCES DATA FOR TENNESSEE, WATER YEAR 1976.
Geological Survey, Nashville, TN. Water Resources Div.
Water-Data Report TN-76-1, June 1977. 520 p, 8 fig.

Descriptors: *Tennessee, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1976 water year for Tennessee consist of records of stage, discharge, and water quality of streams and springs; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of wells. This report contains discharge records for 103 gaging stations; stage only records for one lake gaging station; elevation and contents for 26 lakes and reservoirs; water quality for 50 gaging stations, 80 partial-record flow stations, and 18 wells; and water levels for 27 observation wells. Also included are 118 crest-state partial-record stations and 84 low-flow partial-record stations. Other data were collected and published for miscellaneous stream and spring sites, of as seepage investigations of discharge and water quality. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Tennessee. (Woodard-USGS)
W78-02417

WATER RESOURCES DATA FOR WISCONSIN WATER YEAR 1976.
Geological Survey, Madison, WI. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 291, Price codes: A99 in paper copy, A01 in microfiche.
Water-Data Report WI-76-1, July 1977. 596 p, 8 fig.

Descriptors: *Wisconsin, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water-resources data for the 1976 water year for Wisconsin include records of streamflow at gaging stations, partial-record stations, and miscellaneous sites; records of reservoir storage, records of chemical, physical and biological characteristics of surface water, ground water, and precipitation, and records of water levels in observation wells. Records for a few gaging stations in bordering states also are included. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Wisconsin. (Woodard-USGS)
W78-02418

WATER RESOURCES DATA FOR NEW MEXICO, WATER YEAR 1976.
Geological Survey, Albuquerque, NM. Water Resources Div.
Water-Data Report NM-76-1, November 1977. 655 p, 6 fig.

Descriptors: *New Mexico, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1976 water year for New Mexico consist of records of discharge and water quality of streams; stage, contents and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This report contains discharge records for 212 gaging stations; stage and contents for 24 lakes and reservoirs; water quality for 67 gaging stations, 19 partial-record stations, 1 reservoir, 8 springs and 205 wells; and water levels for 98 observation wells. Also included are 155 crest-stage partial-record stations and 3 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. U.S. Geological Survey and cooperating State and Federal agencies in New Mexico. (Woodard-USGS)
W78-02419

WATER RESOURCES DATA FOR NEW HAMPSHIRE AND VERMONT, WATER YEAR 1976.
Geological Survey, Boston, MA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 093, Price codes: A10 in paper copy, A01 in microfiche.
Water-Data Report NH-VT-76-1, August 1977. 208 p, 2 fig, 1 tab.

Descriptors: *New Hampshire, *Vermont, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water-resources data for the 1976 water year for New Hampshire and Vermont consist of records of stage, discharge, and water quality of streams; contents of lakes and reservoirs; and ground-water levels. This report contains discharge records for 92 gaging stations, stage records for 4 lakes, monthend contents for 28 lakes and reservoirs, water quality for 9 gaging stations, and water levels for 18 observation wells. Also included are data for 41 crest-stage and 13 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. A few pertinent stations (not included above) in bordering States and Province of Quebec are also included in this report. These data represent that portion of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in New Hampshire and Vermont. (Woodard-USGS)
W78-02420

WATER RESOURCES IN WESTERN CORTLAND COUNTY, NEW YORK: HYDROLOGIC DATA FOR 1972-75 AND PROGRESS REPORT,
Geological Survey, Ithaca, NY. Water Resources Div.
H. L. Shindel, W. Buller, and W. H. Johnston.
Open-file report 77-525, September 1977. 36 p, 11 fig, 17 tab, 7 ref.

Descriptors: *Hydrologic data, *Surface waters, *Groundwater, *Water quality, *New York, Streamflow, Flow rates, Rainfall-runoff relationships, Groundwater movement, Inflow, Streams, Base flow, Chemical analysis, Biological properties, Chemical properties, Cortland County(N Y), Gridley Creek, Virgil Creek, Otter Creek, Tioughnioga River.

Basic data on the surface water, ground water, and water quality of Cortland County, New York, are presented with a short explanatory text. Seepage investigations showed that during periods of base flow, the surface-water regime cannot be predicted on the basis of flow-duration figures alone. The investigations also indicate that the streambeds are permeable for extended reaches throughout the areas studied. Inconsistent data on gain or loss for a given reach are assumed to be indicative of the changes in rate of ground-water recharge or discharge. Analysis of surface-water quality since 1972 showed high nitrate (as NO3) concentrations (4 to 18 mg/liter) in the Cortland area and in Factory Brook. The nitrate source is probably from human activities. Although ground water in the Gridley Creek basin is moderately hard (34 to 140 mg/liter CaCO3), it generally meets standards of the New York State Department of Health. (Woodard-USGS)
W78-02422

HYDROLOGIC RECONNAISSANCE OF THE EASTERN NORTH SLOPE, ALASKA, 1975,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 4A.
W78-02424

SOLUTION OF THREE-DIMENSIONAL GROUND-WATER FLOW EQUATIONS USING THE STRONGLY IMPLICIT PROCEDURE,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W78-02428

GROUND-WATER DATA FOR THE DREWSEY RESOURCE AREA, HARNEY AND MALHEUR COUNTIES, OREGON,
Geological Survey, Portland, OR. Water Resources Div.
J. B. Gonthier, C. A. Collins, and D. B. Anderson.
Open-file report 77-741, September 1977. 28 p, 4 fig, 1 plate, 5 tab, 15 ref.

Descriptors: *Groundwater resources, *Water quality, *Water wells, *Water levels, *Well data, Oregon, Hydrographs, Observation wells, Driller logs, Lithologic logs, Chemical analysis, Maps, Water utilization, Drewsey resource area(Oreg), Harney County, Malheur County.

Appraisals of the resources of selected management areas in eastern Oregon are being made by the U.S. Bureau of Land Management. To provide needed hydrologic information the Bureau of Land Management requested the U.S. Geological Survey Water Resources Division to inventory ground-water data for the Drewsey Resource Area. Included in this report are well data, drillers' lithologic logs, hydrographs, a summary of observation-well data, and chemical analyses of ground water. (Woodard-USGS)
W78-02430

MAP SHOWING DRAINAGE BASINS AND LOCATION OF STREAMFLOW-MEASURING SITES, FAIRFAX COUNTY, VIRGINIA,
Geological Survey, Reston, VA. Water Resources Div.
E. H. Mohler.
Open-file report 77-270, 1977. 1 sheet, 2 ref.

Descriptors: *Watersheds(Basins), *Drainage areas, *Maps, *Gaging stations, *Streams, Sites, *Virginia, Fairfax County(Va).

A drainage basin map of Fairfax County shows basins for named streams with drainage areas of 1.1 sq mi (2.8 sq km) or more. Areas of minor streams draining directly into the Potomac River and Occoquan Creek are tabulated. The locations of continuous-record and partial-record (peak-flow and low-flow) flow sites are shown. The use of topographic and climatic characteristics of

drainage basins to transfer flow data from gaged areas to ungaged areas is discussed. (Woodard-USGS)
W78-02431

DESIGN FOR A UNIFIED SYSTEM FOR CHARACTERIZING CONTINENTAL BODIES OF WATER AND ITS USE FOR WATER QUALITY ANALYSIS, (IN RUSSIAN),
For primary bibliographic entry see Field 5A.
W78-02559

FLOOD PLAIN INFORMATION: LITTLE CREEK, PRINCE WILLIAM COUNTY, VA,
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 4A.
W78-02623

FLOOD PLAIN INFORMATION: MILL RUN, BLAIR COUNTY, PENNSYLVANIA.
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 4A.
W78-02624

FLOOD PLAIN INFORMATION: LUZERNE COUNTY, PENNSYLVANIA, SUSQUEHANNA AND LACKAWANNA RIVERS.
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 4A.
W78-02627

FLOOD HAZARD INFORMATION: CHAMBERS CREEK, EVERMAN, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 4A.
W78-02628

FLOOD PLAIN INFORMATION: CIENEGAS CREEK AND CANTU BRANCH, DEL RIO, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 4A.
W78-02629

FLOOD PLAIN INFORMATION: MARYS AND SOUTH MARYS CREEKS, FORT WORTH, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 4A.
W78-02630

FLOOD PLAIN INFORMATION: MONAHANS DRAW, ODESSA, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 4A.
W78-02631

SPECIAL FLOOD HAZARD INFORMATION: WALNUT BRANCH, SEGUIN, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 4A.
W78-02632

FLOOD PLAIN INFORMATION: CRUMP CREEK, HANOVER COUNTY, VIRGINIA.
Army Engineer District, Norfolk, VA.
For primary bibliographic entry see Field 4A.
W78-02633

FLOOD PLAIN INFORMATION: JAMES RIVER AT RICHMOND, VA.
Army Engineer District, Norfolk, VA.
For primary bibliographic entry see Field 4A.
W78-02634

FLOOD PLAIN INFORMATION: MECHUMPS CREEK, HANOVER COUNTY, VA.
Army Engineer District, Norfolk, VA.
For primary bibliographic entry see Field 4A.
W78-02635

FLOOD PLAIN INFORMATION: SWIFT CREEK, CHESTERFIELD COUNTY, VA.
Army Engineer District, Norfolk, VA.
For primary bibliographic entry see Field 4A.
W78-02636

FLOOD PLAIN INFORMATION: TOTOPOTOMOY CREEK, HANOVER COUNTY, VA.
Army Engineer District, Norfolk, VA.
For primary bibliographic entry see Field 4A.
W78-02637

FLOOD PLAIN INFORMATION: MONONGAHELA RIVER, CARROLL TOWNSHIP, DONORA, AND FALLOWFIELD TOWNSHIP, WASHINGTON COUNTY, PENNSYLVANIA.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 4A.
W78-02638

FLOOD PLAIN INFORMATION: MONONGAHELA RIVER, CENTERVILLE BOROUGH AND EAST BETHLEHEM TOWNSHIP, WASHINGTON COUNTY, PA.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 4A.
W78-02639

FLOOD PLAIN INFORMATION: MONONGAHELA RIVER, FAYETTE COUNTY, PENNSYLVANIA.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 4A.
W78-02640

FLOOD PLAIN INFORMATION: MONONGAHELA RIVER, MONESSEN AND ROSTRAVER TOWNSHIP, WESTMORELAND COUNTY, PENNSYLVANIA.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 4A.
W78-02641

FLOOD PLAIN INFORMATION: MONONGAHELA RIVER, UNION TOWNSHIP, NEW EAGLE, AND MONONGAHELA, WASHINGTON COUNTY, PA.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 4A.
W78-02642

FLOOD PLAIN INFORMATION: NESHANNOCK CREEK BASIN, LAWRENCE COUNTY, PENNSYLVANIA--MAIN REPORT AND TECHNICAL APPENDIX.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 4A.
W78-02643

FLOOD PLAIN INFORMATION: OHIO AND BEAVER RIVERS, BEAVER COUNTY, PENNSYLVANIA.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 4A.
W78-02644

8. ENGINEERING WORKS

8A. Structures

THERMAL REGIME OF AN EARTH DAM BUILT ON A PERMAFROST BASE DURING CONSTRUCTION AND INITIAL OPERATION,
Gorkovskii Inzhenerno-Stroitelnyi Inst. (USSR).
For primary bibliographic entry see Field 8D.
W78-02237

ECONOMIC/DEMOGRAPHIC ASSESSMENT MANUAL: CURRENT PRACTICES, PROCEDURAL RECOMMENDATIONS, AND A TEST CASE,
Arizona State Univ., Tempe. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W78-02274

UNDERGROUND TANK USED FOR STORM WATER DETENTION.
Water and Wastes Engineering, Vol. 14, No. 9, p 59, September, 1977.

Descriptors: *Construction materials, *Storm runoff, *Underground storage, *Storage tanks, Storage requirements, Urban runoff, Equipment, Waste water treatment, Alexandria(VA).

An underground fiberglass storage tank was chosen by VVKR Partnership as a solution to storm water detention needs at the Alexandria Hospital in Virginia. City ordinances and existing storm water runoff problems required the construction of storm water detention facilities when Alexandria Hospital constructed additional parking facilities. The required storage volume for the 5-acre site was estimated at 600 cu ft of water for a 18-yr rainfall intensity and a release rate of 6.4 cu ft per second. Conventional methods of storm water detention such as surface storage ponds, below-grade storage in concrete chambers, oversized pipes, and gravel interceptors were rejected because of costs, maintenance requirements, and specific problems related to the site. Manufactured by Owens-Corning Fiberglass, the 75-ft long, 10-ft dia tank was shipped in two sections and was equipped with a special junction box to control the release rate. (Schulz-FIRL)
W78-02296

8B. Hydraulics

THE MOVEMENT OF SUSPENDED PARTICLES DUE TO SUDDEN RELEASE OF WATER FROM A LONG PRISMATIC FLUME,
Mississippi State Univ., Mississippi State. Dept. of Agricultural and Biological Engineering.
J. C. McWhorter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 597, Price codes: A03 in paper copy, A01 in microfiche. Mississippi State University Water Resources Research Institute, Completion Report, October 1977. 23 p, 16 fig, 2 ref. OWRT A-106-MISS(1), 14-34-0001-7052.

Descriptors: *Suspended solids, Flow characteristics, *Flumes, *Unsteady flow, Equipment, Measurement, *Particle size, *Particle shape, Velocity, Open channel flow.

The purpose was to acquire qualitative and quantitative knowledge of the movement of suspended particles in water following sudden release of the suspension from one end of a long, straight, horizontal flume of rectangular cross section. This laboratory study made use of a glass-walled flume and auxiliary photographic and timing equipment. This equipment enabled the observation and recording of movement of particles that were suspended or in contact with the flume bottom.

The particles tested were small polyethylene pellets and spheres of two different diameters that were somewhat larger than the pellets. All particles had a specific gravity just slightly greater than unity. Four different initial water depths were used. Qualitative observations as to particle motion, in regard to both direction and relative magnitude, are reported. Quantitative data regarding average velocities are shown graphically.
W78-02205

IMPROVED DESIGN AND OPERATING CRITERIA FOR RURAL WATER DISTRICTS (PHASE II),
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 6D.
W78-02206

DEBRIS OF THE CHENA RIVER,
Cold Regions Research and Engineering Lab., Fairbanks, AK. Alaska Projects Office.
For primary bibliographic entry see Field 2J.
W78-02238

PORT IMPROVEMENT DESIGN CRITERIA FOR TEXAS COAST,
Texas A and M Univ., College Station. Ocean Engineering Program.
J. W. Berriman, and J. B. Herbich.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol 103, No WW4, Proceedings Paper 13322, p 487-504, November 1977. 16 fig, 5 tab, 18 ref, 1 append.

Descriptors: *Harbors, *Coastal engineering, *Navigation, *Texas, Ships, Coasts, Channels, Transportation, Excavation, Dredging, Design, *Design criteria, Deep water, Estuaries, *VLCC ports, Harbor facilities, Port improvement.

Navigation facilities must be designed for good control and safe maneuvering of ships. Channel dimensions for safe navigation were calculated on the basis of existing knowledge and were presented for vessels of 100,000, 150,000, and 250,000 deadweight tons. (Sims-ISWS)
W78-02245

STORM TIDE FREQUENCIES FOR CAPE FEAR RIVER,
National Weather Service, Silver Spring, MD. Office of Hydrology.
V. A. Myers, and J. E. Overland.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 103, No. WW4, Proceedings Paper 13337, p 519-535, November 1977. 10 fig, 5 tab, 15 ref, 1 append.

Descriptors: *Storms, *Floods, Estuaries, *North Carolina, Model studies, Mathematical models, Rivers, Hurricanes, Tides, Tidal effects, Storm surge, Coasts, Continental shelf, Data processing, Frequency analysis, *Cape Fear River(NC).

Frequencies of storm tides, principally from hurricanes, in the Cape Fear River, North Carolina, below Wilmington were calculated by applying two previously developed numerical-hydrodynamic models to simulating surges from a large number of hypothetical hurricanes, chosen so as to collectively represent all climatologically expected hurricanes. The models are the continental shelf model of Jelesnianski and a model for the Cape Fear River by the writers. The recurrence interval of each hypothetical hurricane and its simulated tide were derived by combining the probabilities of the several parameters that define each storm. A methodology for carrying out the frequency evaluation economically was illustrated. The 100-yr return period tide level at Wilmington was estimated to be between 10 ft and 11 ft mean sea level. (Sims-ISWS)
W78-02247

EFFECT OF SEDIMENT GRADATION ON CLEAR WATER SCOUR,
Auckland Univ. (New Zealand). Dept. of Civil Engineering.
A. J. Raudkivi, and R. Ettema.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 103, No. HY10, p 1209-1213, October 1977. 2 fig, 6 ref, 1 append.

Descriptors: *Scour, *Laboratory tests, *Piers, *Erosion, Streambeds, Stream erosion, Depth, Analysis, Foreign research, Bridges, Gradation, Sediments.

A comparison of the published experimental data on scour depths at bridge piers showed a large range of values at what appear to be identical conditions. Therefore, it was decided to investigate whether or not the variation could arise from different grain size distributions of the bed material used. The experiments were carried out in a recirculating flume 38 m long, 1.5 m wide, and 1.2 m deep, using a 100 mm diam cylindrical pier. In the experiments, the d sub 50 grain size and the grain size distribution were varied systematically. Trial runs showed that for a given shear velocity, depth of flow greater than about two pier diameters, 2D, had no observable effect on the depth of scour, and thereafter all tests were run at a flow depth of 0.60 m, or six pier diameters. The velocity of the approach flow and the shear velocities were determined from the slope of the velocity distribution. The investigation showed that the maximum depth of clear water scour, d sub s is: (1) A function of the standard deviation, sigma, of the grain size distribution of the bed material; and (2) independent of the grain size in gravel beds where d sub s/D is about 2.1-2.3 for sigma = 0 and decreases with increasing sigma/d sub 50. (Humphreys-ISWS)
W78-02248

BEDLOAD TRANSPORT BY TRANSLATION WAVES,
Ministry of Works and Development, Christchurch (New Zealand). Water and Soil Research.
G. A. Griffiths, and A. J. Sutherland.
Journal of the Hydraulics Division, American Society of Civil Engineers, Proceedings Paper 13363, Vol. 103, No. HY11, p 1279-1291, November 1977. 5 fig, 1 tab, 12 ref.

Descriptors: *Bed load, *Waves(Water), *Model studies, Channels, Flood routing, Hydraulics, Hydrology, Sediment transport, Mathematical models, Rivers, Sedimentation, *Triangular translation waves, Equilibrium, Steady-state sediment hydrograph, Nonsteady sediment hydrograph.

The response of a gravel bed reach to imposed steady flows and to gradually varying triangular translation waves was examined; first, under equilibrium transport conditions, and second, with no bedload inflow. With equilibrium transport, no significant differences could be found between the sediment hydrograph associated with a wave and the comparable steady-state sediment hydrograph. This result, combined with the observed but small variation in resistance, implies that the use of steady-state resistance and bedload formulas in a mathematical model of the situation can be justified. With nonequilibrium transport, differences occurred between measured nonsteady sediment hydrographs and the comparable steady hydrographs due to a bed response effect. This diminished towards the downstream end of the scour region associated with a wave's passage. Consequently, mathematical model performance would be poor when the reach length is less than the scour hole length. (Lee-ISWS)
W78-02249

STATISTICAL PROPERTIES OF SEDIMENT BED PROFILES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W78-02251

SETTLEMENT OF SOLID PARTICLES IN OPEN-CHANNEL FLOW,
Technical Univ. of Istanbul (Turkey). Dept. of Civil Engineering.
B. M. Sumer.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 103, No HY11, Proceedings Paper 13368, p 1323-1337, November 1977. 6 fig, 1 tab, 11 ref, 3 append.

Descriptors: *Sedimentation, *Open channel flow, *Model studies, Mathematical models, Analytical techniques, Turbulence, Settling velocity, Deposition(Sediments), Flow, Diffusion, Suspended solids, Settling basins, Canals, Sedimentology, Solid particle settlement.

Settlement of solid particles in turbulent water environment is encountered in various fields of engineering. Settling basins of hydro-power plants or settling tanks of water treatment plants serve as units for removing suspended solid particles, where the solid particles settle out of suspension due to gravity. When a small heavy particle is released into a turbulent open-channel flow, it moves in the vertical direction under the combined action of: (1) gravity; and (2) vertical component of turbulence. If the former is dominant, the particle will finally settle out of suspension. In this analysis, the boundary condition at the bed is assumed so that the particles coming to the bed are deposited and there is no particle entrainment from the bed into the flow. The boundary condition at the free surface is such that there is no net transport of particles across the free surface. The initial condition is assumed as an instantaneous plane source. The problem was formulated in the Eulerian sense and then Aris moment transformations were employed. The following quantities were predicted analytically: (1) the vertical distribution and the fraction of particles retained in suspension; (2) the probability density function of the duration of the retention period of particles in suspension and the mean retention period; and (3) following the hypothesis that the distribution of deposited partciels follows an exponential function with increasing time, the mean and the variance of settling length of particles. (Sims-ISWS)
W78-02252

OBSERVATIONS OF SHEAR IN NEAR-BED CURRENTS IN THE SOUTHERN NORTH SEA,
University of East Anglia, Norwich (England). School of Environmental Sciences.
J. G. Harvey, and C. E. Vincent.
Estuarine and Coastal Marine Science, Vol 5, No 6, p 715-731, November 1977. 10 fig, 2 tab, 30 ref.

Descriptors: *Ocean currents, *Tides, *Currents(Water), Measurement, On-site investigations, Circulation, Water circulation, Ocean circulation, Current meters, Tidal effects, Flow, Offshore platforms, Equipment, Instrumentation, Data processing, Oceanography, *North Sea.

Measurements of current speed and direction were made at four heights between 0.6 m and 10 m above the sea-bed at a location in the southern North Sea during a 14-day period. Tidal ellipses were presented for the currents at each height for both neap and spring tides. Speed profiles indicated that there is a logarithmic layer in the lowest 5 m of the water column; both the roughness lengths and the drag coefficients determined from the profiles decreased with increasing current speed. The current directions were found to exhibit positive veering, some 8 deg between 0.6 m and 3.0 m above the bed, and a further 7 deg

between 3.0 m and 10 m above the bed. The maximum currents when the flow was directed between north and northwest (the ebb) were consistently stronger than those when it was directed between south and southeast (the flood) at each of the levels, and hence the residual currents were in the ebb direction. The residual currents were generally greater during spring tides than during neap tides, and also exhibited positive veering: the 14-day vector-mean current 0.6 m above the bed was directed some 25 deg to the left of that at 10 m. The residual flow can be considered part of a clockwise circulation around the Well Bank. (Sims-ISWS)
W78-02256

SEDIMENT PREDICTION IN THE EASTERN UNITED STATES,
North Carolina State Univ. at Raleigh. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W78-02259

EXPERIMENTAL STUDY OF DRAINAGE BASIN EVOLUTION AND ITS HYDROLOGIC IMPLICATIONS,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 4D.
W78-02262

PILOT-SCALE DRILLING-RESEARCH EFFORTS CAN AID IN MUD DESIGN,
Amoco Production Co., Tulsa, OK.
For primary bibliographic entry see Field 8C.
W78-02284

PROVINCIAL DRILLING METHODS IN BANGLADESH: PART I,
National Water Well Association, Worthington, OH.
J. A. Hunt.
Water Well Journal, Vol. 31, No. 12, p 52-54, December, 1977.

Descriptors: *Water wells, Gravels, Well filters, Well casings, Wells, Construction materials, Plastics, Deltas, Sands, Water table, Water-bearing formations, Drawdown, Transmissivity, Observation wells, *Bangladesh, Tubewells, Gravel-packs.

Drillers in third world nations must utilize innovative methods suited to existing conditions. Experiments were run to find a low-cost tubewell design for use in Bangladesh that could be constructed of materials produced or available locally. Bangladesh in underlain by poorly-sorted, unconsolidated, deltaic sands, silts, and clays with a high water table. Four-inch tubewells producing 224 gpm can supply 20 acres, and six-inch wells can supply 500 gpm for cooperative groups with larger acreage. In addition to PVC or steel casing and filters, tubewells required gravel packing, which was held to 1-2 1/2 inch thicknesses to reduce costs. The poorly sorted, angular gravel was poured into the annular space from all sides at once. Filters of various slot-sizes were used. Observation wells showed great variation among aquifers, but yielded little other useful data. Completed wells successfully supplied water, however. (Palmer-NWWA)
W78-02286

SCANNER, ORIENTER HELP FIND CASING LEAKS,
For primary bibliographic entry see Field 8G.
W78-02287

BEAM BEHAVIOR OF BURIED RIGID PIPELINES,
California Univ., Berkeley. Sanitary Engineering Research Lab.
F. H. Pearson.
Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol. 103, No. EE5, p 767-783, October, 1977. 7 fig, 9 ref, 3 append.

Descriptors: *Pipelines, *Stress analysis, *Bearing strength, *Structural behavior, *Structural design, Sewers, Design criteria, Elastic theory, Shear, Strength of materials, Structural engineering, Mathematical models, Waste water treatment.

Buried rigid piplines or sewer lines can behave longitudinally as beams, developing shear forces and bending moments if subjected to nonuniformly distributed loads or reactions. Since current pipeline design criteria only consider minimum depth of cover and pipe length with respect to beam behavior, theories and applications of elastic beam behavior are discussed with respect to pipelines. Equations are presented defining the two categories of characteristic pipe length on which the elastic foundations of beam behavior are based. For short pipes the bedding reactions as well as the shear forces and bending moments induced in the pipe can be described by static analysis. For a longer pipe static analysis would, however, give higher than actual values for shear and moments due to a concentrated load. Bedding reactions and moments and shears in short pipes are discussed with respect to the effects of a concentrated surface load and of a nonuniformly distributed earth load. Dimensionless parameters of deflection, slope, moment, and shear are discussed for point loading and a concentrated surface load with respect to pipe of infinite length. Shears and moments are discussed with respect to medium-length pipes in which the maximum bending moment occurs at the point of application of the load. Practical applications are presented with equations to estimate the shear forces in spigot- and bell-jointed buried rigid pipelines and in O-ring jointed pipelines under anticipated normal conditions of construction and control; and to calculate the maximum bending moment in a buried pipe due to a surface load such as a truck wheel. (Schulz-FIRL)
W78-02310

SHALLOW WAVE DIFFRACTION AROUND LARGE CYLINDER,
British Columbia Univ., Vancouver. Dept. of Civil Engineering.
M. de St. Q. Isaacson.
Journal of the Waterway, Port, Coastal, and Ocean Division, Proceedings of the American Society of Civil Engineers, Vol 103, No WW1, p 69-82, February 1977. 4 fig, 45 equ, 15 ref.

Descriptors: *Waves(Water), *Dimensional analysis, Coastal engineering, Hydrodynamics, Shallow water, Design, Equations, *Diffraction theory, *Wave dispersion, *Offshore structures, *Cylinders, Cnoidal waves.

The diffraction of cnoidal waves around a large vertical circular cylinder is investigated. First approximations are derived for the velocity potential of the flow field and consequently for the wave loading on the cylinder. The forces may be appreciably larger than predicted on the basis of shallow water sinusoidal wave theory, and the consequences on the design of large offshore structures in shallow water are assessed. The possibility of extending the theory to a second approximation is examined. (Bell-Cornell)
W78-02447

INVESTIGATIONS OF THE DUNES GEOTHERMAL ANOMALY, IMPERIAL VALLEY, CALIFORNIA: PART 1, GEOCHEMISTRY OF GEOTHERMAL FLUIDS,
California Univ., Riverside. Inst. of Geophysics and Planetary Physics.
For primary bibliographic entry see Field 2F.
W78-02535

INVESTIGATIONS OF THE DUNES ANOMALY, IMPERIAL VALLEY, CALIFORNIA: PART II, PETROLOGICAL STUDIES,
California Univ., Riverside. Dept. of Earth Sciences.
For primary bibliographic entry see Field 2F.
W78-02536

GOVERNING EQUATIONS FOR GEOTHERMAL RESERVOIRS,
Systems, Science and Software, La Jolla, CA.
For primary bibliographic entry see Field 2F.
W78-02542

NEW TECHNOLOGY OF DRILLING WELLS IN PERMAFROST: CHAPTER 6, DRILLING WITH SIMULTANEOUS FREEZING OF WET, LOOSE ROCKS,
Cold Regions Research and Engineering Lab., Hanover, NH.
B. B. Kudriashov, and A. M. Iakovlev.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-026 676, Price codes: A03 in paper copy, A01 in microfiche. Draft Translation 517, 1976, CRREL Access. No. 29-1641. 10 p, 5 fig, 1 tab. Translated from Novaia Tekhnologiia Bureniia Skvazhin V Merzlykh Porodakh, Leningrad, 1973, p 135-143.

Descriptors: *Core drilling, *Permafrost, Drilling fluids, Wells, Mathematics, Boreholes, Rock mechanics, Heat flow, Coolants, Ice, Freezing, Sampling, *Leningrad Mining Institute.

The method of drilling with simultaneous freezing ahead of the drill involves the circulation in the well of a low-temperature, washing refrigerating agent during the drilling process. Moisture contained in the formation freezes to form strong ice-and-rock crusts in the borehole walls, the core, and bottom (face). Advantages of this method are greater hole stability and improved quality of sampling for coring operations in permafrost environments. Hole diameters can be sharply reduced as well, which eliminates the need for taking heavy drilling rigs into rugged or swampy terrain. Kerosene cooled by dry ice is one example of a refrigerant fluid system that has been tested successfully with this method. The bulk of the text is devoted to the mathematics of freezing ahead of drilling. An analytical solution is obtained on the basis of the theory of moving thermal sources. Relationships between depth of freezing ahead of the bit and drilling rate are discussed. (Eberle-NWWA)
W78-02544

LABORATORY TESTS OF RELIEF WELL FILTERS: REPORT 1, WELLS ALONG THE MISSISSIPPI RIVER LEVEES, ALTON TO GALE, ILLINOIS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
F. Mitronovas.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 368, Price codes: A03 in paper copy, A01 in microfiche. Miscellaneous paper S-68-4, May, 1968. 41 p, 20 fig, 5 tab.

Descriptors: *Well filters, *Well screens, Sands, Specific yield, Gravels, Gradation, Head loss, Pumping, Levees, Mississippi River, Laboratory tests, Water wells, *Relief wells, *Migration of fines, Clogging, Segregation, Surging.

The relief well system along the Mississippi River levees between Alton and Gale, Illinois, was installed in a sand and gravel aquifer during the period 1953-1955. Results from subsequent pumping tests showed a steadily decreasing specific yield in the system, possibly due to the clogging of gravel filters surrounding the well screens. Though the validity of the gravel filter design had been established by field and laboratory tests, ac-

cidental departure from the design may have occurred due to segregation of gravel during shipment and placement or because of variation in the gradation of the source material. The investigation reported here was undertaken to obtain data on three filter samples, one of which has the standard gradation specified for the well system, and two others representing gradations that might have developed had accidental segregation of material occurred. Hydraulic head losses were found to be significantly less than would account for the efficiency reductions in the relief wells; it was thus concluded that variation in gradation of filter gravel may lead to well failure due to piping of sand, but that it is not a major factor in causing reductions of well efficiency due to clogging of filter gravel with formation sand. (Eberle-NWWA)
W78-02545

RESERVOIR EVALUATION TESTS ON RRGE 1 AND RRGE 2, RAFT RIVER GEOTHERMAL PROJECT, IDAHO,
California Univ., Berkeley. Lawrence Berkeley Lab.
For primary bibliographic entry see Field 4B.
W78-02549

ESTIMATING AQUIFER PERMEABILITY BY SURFACE ELECTRICAL RESISTIVITY MEASUREMENTS,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2F.
W78-02551

GEOTHERMAL RESOURCES, EXPLORATION AND EXPLOITATION: A BIBLIOGRAPHY.
Department of Energy, Oak Ridge, TN. Technical Information Center.
Available from the National Technical Information Service, Springfield, VA 22161 as TID-3354-R1, Price codes: A99 in paper copy, A01 in microfiche. Publication No. TID-3354-R1, July, 1976. 628 p, 5476 ref, 1 append.

Descriptors: *Geothermal studies, *Bibliographies, Exploration, Surveys, Technology, Sites, Equipment, Economics, Thermal power, Thermal powerplants, Electric power production, Corrosion, Brines, Geochemistry, Drilling, Legal aspects, Environmental effects.

To aid the industrial and scientific community concerned with geothermal resource exploration and development, the ERDA Technical Information Center has cataloged, indexed, and stored in machine-readable form a major portion of the scientific and technical information published on this subject. The coverage dates back as far as useful references could be obtained and was current at the time of this bibliography's publication. Citations listed may be recalled on the RECON computer retrieval system. References are arranged in broad subject categories and are made up of complete bibliographic citations. These are followed by a listing of subject descriptors used to describe the content of each reference for machine storage and retrieval. Subject, Author, Corporate, and Report Number indexes are provided. (Eberle-NWWA)
W78-02553

WAVES GENERATED BY HORIZONTAL OSCILLATIONS IN BAYS,
Tetra Tech, Inc., Pasadena, CA. Engineering Div.
Y. K. Lee, and L-S. Hwang.
Journal of the Waterway, Port, Coastal, and Ocean Division, American Society of Civil Engineers, Vol 103, No WW4, Proceedings Paper 13316, p 411-422, November 1977. 8 fig, 1 tab, 5 ref, 2 append. NSF GI-38982.

Descriptors: *Waves(Water), *Resonance, *Numerical analysis, Coastal engineering, Harbors, Bays, Hydrodynamics, Seismic design, Equations, Mathematical studies, *Integral equations, *Linear wave theory, *Wave generation, Oscillations, Amplitude.

The waves generated in a coastal basin by the horizontal components of ground motion (e.g., during an earthquake) were studied. Special emphasis was placed on the resonant response of the basin of arbitrary boundary shape and uniform depth for idealized motions. An integral equation technique with numerical solution was presented. Results showed that the waves generated at resonant frequencies are significant in a semi-enclosed coastal basin with horizontal ground displacement amplitudes typical of large earthquakes. (Adams-ISWS)
W78-02600

TIDAL PRISM OF EQUILIBRIUM INLETS,
Toups and Loiederman, Rockville, MD.
M. Krishnamurthy.
Journal of the Waterway, Port, Coastal, and Ocean Division, American Society of Civil Engineers, Vol 103, No WW4, Proceedings Paper 13315, p 423-432, November 1977. 2 fig, 2 tab, 10 ref, 3 append.

Descriptors: *Inlets(Waterways), *Equilibrium, *Sediment transport, *Tidal effects, Tides, Channels, Hydraulics, Open channel flow, Shear stress, Particle size, Regime, Stability, *Tidal prism, Tidal flow.

The magnitude of tidal prism depends on the cross sectional area of the inlet. When an inlet is in equilibrium, many investigators have established a relationship between the two parameters. In this paper, a formula was derived to estimate the value of tidal prism of an equilibrium inlet taking the range and period of the ocean tide, flow resistance of the channel, and the size of the bed material of the inlet into consideration. This formula was compared with the available formulas and verified using data of existing equilibrium inlets. (Adams-ISWS)
W78-02601

SHOALING RATES AND RELATED DATA FROM KNIK ARM NEAR ANCHORAGE, ALASKA,
Coastal Engineering Research Center, Fort Belvoir, VA.
C. H. Everts, and H. E. Moore.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-027 095, Price codes: A05 in paper copy, A01 in microfiche. Technical Paper No. 76-1, March 1976. 83 p, 35 fig, 3 tab, 6 ref, 4 append.

Descriptors: *Sediments, *Shoals, *Alaska, Bulk density, Currents(Water), Tides, Navigation, Sediment transport, Hydraulics, Boats, *Anchorage(Alaska), *Accretion rate, Harbor shoaling, Small-craft harbors, Navigation channels.

In high tidal range areas where large quantities of fine-grained sediment are carried in suspension, the potential for harbor shoaling is great. Because of high current speeds resulting from the tides and because of winter ice conditions, many small-craft harbors in Alaska are constructed as enclosed basins connected to estuaries by a navigation channel. Such harbors, as typified by Dillingham Harbor where the shoaling rate is 6 feet per year, become sediment traps. This study measured summer shoaling rates in 1971 and 1972 in a sedimentation tank located on a tidal flat near Anchorage, Alaska. The mean shoaling rate was 0.073 foot per day in 1971, and 0.06 foot per day, or 15% less in 1972. Shoaling rates were uniform throughout the summer tests; the sediment surface in the 12-foot-diameter tank remained level. The accretion rate in the tank was 10 times as great as the rate on the adjacent tidal flat. Bulk density in the tank increased nonlinearly from the depositional surface to the bottom. The mass accretion rate was about 1.9 pounds per square foot per tidal cycle in 1971, and 1.6 pounds per square foot per tidal cycle in 1972. The mean particle size was 0.0058 millimeter in 1971, and 0.0068 millimeter in 1972. Size varied daily, but not at different collection stations in the tank. Vertical and horizontal circulation in the tank was not observed. Data concerning the characteristics of the fluid and sediment, the suspended sediment concentrations inside and outside the basin, and current velocities near the basin were obtained. (Lee-ISWS)
W78-02608

COASTAL CHANGES, EASTERN LAKE MICHIGAN, 1970-73,
Western Michigan Univ., Kalamazoo.
For primary bibliographic entry see Field 2J.
W78-02609

EFFECTS OF SPECIMEN RECONSTITUTION ON CYCLIC TRIAXIAL RESULTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Soils and Pavements Lab.
For primary bibliographic entry see Field 8D.
W78-02610

8C. Hydraulic Machinery

DIGITAL LOAD CONTROL FOR HYDROELECTRIC POWERPLANTS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
W. B. Gish.
Report No REC-ERC-77-10, August 1977. 76 p, 13 fig, 5 ref, append.

Descriptors: *Load-frequency control, *Computer applications, *Algorithms, *Supervisory control(Power), Automatic control, Control systems, Computer programing, Governors, Data transmission, Feedback, Power dispatching, Power system operations, Generating capacity, Spinning reserve, Hydroelectric power, Electric generators, Minicomputers.

A typical load controller for a hydroelectric powerplant utilizing a digital computer is described. Flow charts indicating the necessary timing, interface program interaction, logic, and calculations are included. Notes and suggestions to adapt the algorithm to specific applications are also included. (Bur Reclam)
W78-02266

FREQUENCY-RESPONSE ANALYSIS OF AUTOMATED CANALS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
H. T. Falvey.
Report No REC-ERC-77-3, July 1977. 69 p, 25 fig, 3 tab, 11 ref, 3 append.

Descriptors: *Automation, *Canals, *Analytical techniques, *Frequency analysis, *Automatic control, Control equipment, Feedback, Control systems, *Frequency-response method, Computer programs, *Coalinga Canal.

Two methods are available for determining control parameters on automated canals. These are the transient-response method and the frequency-response method. Since a typical canal system is influenced predominantly by transient inputs, the transient-response method has been extensively used in the analysis of automated canal systems. The main advantage of the frequency-response method is that the effects of varying the various control parameters can be readily visualized and evaluated. The presently used transient-response method and parameter selection are reviewed. The basic concepts of the frequency-response method

are presented and their application to an automated reach is illustrated with an example. Two computer programs are given which can be used to determine canal response characteristics. The state-of-the-art in process control has progressed sufficiently so that both the transient-response and frequency-response methods of analysis can be used in a complementary fashion. Employment of only one method in the design of automated systems is, in general, wasteful of both computer time and engineering effort. (Bur Reclam)
W78-02271

COST-EFFECTIVE ELECTRIC POWER GENERATION FROM THE WIND: A SYSTEM LINKING WINDPOWER WITH HYDROELECTRIC STORAGE AND LONG-DISTANCE TRANSMISSION,
Bureau of Reclamation, Denver, CO. Div. of Atmospheric Water Resources Management.
C. J. Todd, R. L. Eddy, R. C. James, and W. E. Howell.
Bur Reclam Engineering and Research Center, Denver, Colorado, August 1977. 29 p, 11 fig, 1 tab, 32 ref.

Descriptors: Wind(Meteorology), *Wind energy, *Windpower, *Power generation, Environmental effects, Social impact, Resource research and development, Systems analysis, Systems research and development, Wind profiles, Wind pressure, Transmission towers, *Cost analysis, Wind Energy Conversion Systems(WECS), Western United States.

The idea of generating windpower at the windiest available sites (wind farms) is examined for its effect on feasibility of large-scale windpower input to the nationwide electric power network. Windpower is considered in association with pumped-storage hydroelectric plants for load leveling and existing types of transmission lines for interconnecting the wind farms and energy-storage sites with load centers up to 2000 km away. Potential energy harvest from wind farm sites in the 17 Western States is estimated at well over 100 GW, and many times this much in arctic North America. At the 100-GW level of development, bus bar cost at the wind farm would be about 3 mills/MJ (10 mills/kWh). Energy storage required for load leveling would add about 1.8 mills/MJ and transmission costs another 2.1 mills/MJ, for a total cost at the load center of 6 mills/MJ (21 mills/kWh), all in 1976 dollars. This would be competitive with energy generated near load centers by new nuclear or fossil-fuel powerplants. Windpower appears environmentally acceptable and avoids many of the environmental liabilities of conventional sources. Large-scale windpower implementation will require major advance commitment of capital, about $1 billion, to lower bus bar costs to 4.4 mills/MJ (16 mills/kWh). The timetable will therefore likely depend on Federal incentives. (Bur Reclam)
W78-02273

EXTRACTION OF GEOTHERMAL ENERGY BY TWO-LOOP SYSTEMS,
Krzhizhanovskii Energeticheskii Inst., Moscow (USSR).
I. T. Alad'yev, Y. V. Spaernov, V. P. Trusov, and V. K. Fardzinov.
Heat Transfer-Soviet Research, Vol. 8, No. 2, p 86-91, March-April, 1976. 3 fig, 1 tab.

Descriptors: *Geothermal studies, *Sedimentary rocks, *Heat transfer, *Thermal power, Heat exchangers, Explosions, Fractures(Geology), Thermal water, *Two-loop geothermal systems, *Geothermal energy.

Geothermal energy is extracted primarily in the form of a water-steam mixture or self-rising hot water. A second source of geothermal energy now under formation and subsequently pumping water through it. Conditions exist in many areas, however, such that neither of the above methods is feasible. Sedimentary rock, for example, may discharge too little hot water for the first-mentioned system and absorb too much pumped water for the latter. An intermediate system is described. To attain high outputs of hot ground water, permeability of part of a sedimentary stratum is increased by underground blasting. Water is pumped into the blast-fractured area, where it receives heat from the ground water and from the rock through which it flows. This heat transfer is effected within the borehole by means of a special heat exchanger. The economics of this type of system are analyzed for depths and diameter of borehole, different sizes of heat exchanger, different pumps, and strength and number of fracturing blasts. (Eberle-NWWA)
W78-02276

GEOTHERMAL ENERGY RECOVERY PROCESS,
Bechtel Corp., San Francisco, CA.
For primary bibliographic entry see Field 3A.
W78-02277

PROCESS DESIGN FOR GEOTHERMAL POWER,
California Univ., Berkeley.
T. K. Sherwood.
Chemical Engineering Progress, Vol. 72, No. 7, p 83-88, July, 1976. 9 fig, 1 tab, 11 ref.

Descriptors: *Geothermal studies, *Thermal power, *Heat exchangers, *Brines, Heat transfer, Corrosion, Flash distillation, Turbines, Steam, Pressure, Cooling towers, Design criteria, *Multistage multi-flash heat exchangers, Rankine cycle, Power fluids, Binary cycle geothermal plants.

Almost all the known geothermal energy resources are in the form of hot brines. Both steam flash and binary cycle process schemes have been studied as means of generating electric power from brines, however, problems of efficiency, equipment corrosion, and brine disposal exist for each method. It has been proposed that the two schemes be combined, the binary cycle being used to recover heat from the large amount of hot brine rejected after one or two flashes of the brine from the well. A system is described that would employ multi-stage flashing with small increments of pressure reduction using the flashed steam for countercurrent heating and vaporization of the binary cycle power fluid. There are many potentially practical power fluids chemically stable at the relatively moderate operating temperatures in a geothermal plant, among which are mixtures of two or more substances. (Eberle-NWWA)
W78-02278

SOLAR IRRIGATION SYSTEM BEGINS OPERATION IN NEBRASKA.
For primary bibliographic entry see Field 3F.
W78-02279

GEOTHERMAL HEAT: TO WHAT EXTENT CAN IT SATISFY OUR ENERGY HUNGER,
For primary bibliographic entry see Field 4B.
W78-02280

GEOTHERMAL DEVELOPMENT OF THE SALTON SEA,
DSS Engineers, Inc., Ft. Lauderdale, FL.
For primary bibliographic entry see Field 3E.
W78-02281

POWER FROM HOT GEOTHERMAL BRINES,
Rotoflow Corp., Los Angeles, CA.
J. S. Swearingen.
Chemical Engineering Progress, Vol. 73, No. 7, p 83-86, July, 1977. 6 fig, 2 tab, 9 ref.

Descriptors: *Geothermal studies, *Brines, *Energy, *Electric power production, Thermal waters, Heat transfer, Costs, Steam, Scaling, Turbines, *Binary systems, Steam flash systems, *Geothermal brines.

Proposed geothermal energy recovery plans generally fall into one of two main groups: (1) the expansion of steam flashed from hot well waters; and (2) the 'binary' system, which involves the transfer of heat from the hot well stream into a secondary boiling clean liquid to generate power. The latter system is more efficient, however, certain problems with scaling of equipment exist due to the chemistry of brines. A method is described for overcoming the scale problem. Heat is transferred from the hot scale-forming into a non-scale-forming water stream by a pair of novel concurrent switching gravel packed beds. The heat is then transferred from this non-scale-forming hot water stream to a power cycle boiling fluid, which in turn drives a unique turbine device. The economic analysis suggests a power production cost of around $1.67 per kilowatt hour. (Eberle-NWWA)
W78-02282

PILOT-SCALE DRILLING-RESEARCH EFFORTS CAN AID IN MUD DESIGN,
Amoco Production Co., Tulsa, OK.
J. C. Estes.
Oil and Gas Journal, Vol. 75, No. 8, p 136-142, November 21, 1977. 7 fig, 1 tab, 8 ref.

Descriptors: *Drilling fluids, *Rotary drilling, Wells, Mud, Flow rates, Temperature, Weight, Particle-size grading, Penetration rates, Microbits, Hydraulic bit cleaning, Drilling speeds, Factorial design, Solids effects, Differential pressures.

The type and condition of drilling mud can be as important in determining drilling efficiency and costs as all other man-controllable variables combined. To test drilling fluid effects, Amoco constructed a pilot-scale drilling machine with a 1 1/4-inch microbit to circulate 1/2 bbl of drilling fluid. Rocks were drilled under pressure for accuracy. Journal bearings of the microbit were isolated from drilling fluid lubrication effects. Tests drilled in limestones are randomly placed to overcome structural variations. Penetration rate for water increased linearly at 0.62 ft/hr. per 10 degrees F (57-190 degrees F), so temperature were identified and described. Complexity of data requires mathematical model to simulate drilling process. Solids effects can be related linearly, however, by comparing penetration using mud to penetration using water under same conditions, if particle-size distribution calculations are made. (Palmer-NWWA)
W78-02284

ECONOMIC ANALYSIS OF GEOTHERMAL ENERGY,
Battelle-Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 3E.
W78-02285

THE POTENTIAL FOR GEOTHERMAL STEAM,
Union Oil Co. of California, Los Angeles.
For primary bibliographic entry see Field 4B.
W78-02288

SOLAR ENERGY TO POWER IRRIGATION PUMPS.
Agricultural Engineering, Vol. 58, No. 7, p 41-2, July, 1977.

Descriptors: *Irrigation engineering, *Pumping, *Energy, Irrigation systems, Solar radiation, *Solar energy, Arizona, *Solar collectors, Rankine cycle turbines.

A sun-powered pump in an experimental irrigation system now operating at Gila Bend, Arizona

presently delivers 10,000 gpm to a 25,000 acre field. The system is a joint project of the Battelle Memorial Institute and Northwestern Mutual Life Insurance Company. Parabolic, tracking solar collectors are used to heat water to 300 degrees F which in turn provides the energy to power a Rankine-cycle turbine engine delivering 50 hp to the irrigation pump. While the present system uses electricity to operate auxiliary components, the design can be adapted for totally automatic operation with no external power. Because the heating and working fluids are in sealed systems, the design has been judged to be environmentally safe. (Eberle-NWWA)
W78-02291

DESALTING GEOTHERMAL BRINES,
California Univ., Berkeley. Sea Water Conversion Lab.
For primary bibliographic entry see Field 3A.
W78-02293

GEOTHERMAL ENERGY: ITS PROMISE FOR THE FUTURE.
For primary bibliographic entry see Field 3E.
W78-02294

FILTER SYSTEM SUCCESSFUL.
Water and Waste Treatment, Vol. 20, No. 7, p 9-10, July, 1977.

Descriptors: *Filters, *Nitrification, *Nozzles, *Pipes, *Activated sludge, Effluents, Plastic pipes, Pumping, Sewage treatment, Waste water treatment, Nozzle systems, Wanlip(UK).

A Delavan-Watson fixed distributor nozzle system is being used on a nitrifying plant at the 20-mgd Wanlip Water Reclamation Works in England. The distributor nozzle system is being used to provide a constant spray of effluent over the filter bed. Standards for the system required Delevan-Watson to design a unit which was capable of giving an even distribution of 20.5 mgd of effluent at a nozzle pressure of 5 psi, and which could be adapted to a distribution of 36 mgd at 7 psi. Effluent from an activated sludge tank is pumped to a 300- x 150-m nitrifying filter. The fixed distributor nozzle system includes sectioned laterals which run the width of the filter bed and are spaced at 3-m intervals along the length of the bed. Cast iron pipes with puddle flanges and cast iron mono-flange butterfly valves comprise the initial sections of the laterals. PVC pipes are used for the remainder of the lateral. Detachable PVC spray nozzles are fitted on the six pipes. (Schulz-FIRL)
W78-02321

ELECTRIC EQUIPMENT FOR MUKOGAWA RIVER SEWAGE TREATMENT PLANT,
Hanshin City Improvement Bureau, Hyogo (Japan).
K. Yokomichi, Y. Nagata, H. Hatada, and T. Tomita.
Toshiba Review, No 109, p 5-12, May-June, 1977. 8 fig, 2 tab.

Descriptors: *Monitoring, *Treatment facilities, *Computers, *Supervisory control(Power), *Automatic control, Sewage treatment, Electronic equipment, Design data, Data processing, Municipal wastes, Electrical design, Waste water treatment, Mukogawa River(Japan).

Operation of the Mukogawa River Sewage Treatment Plant is controlled and supervised by a large process computer, a TOSBAC-7000/25. The Mukogawa plant is designed to treat and average volume of combined municipal and industrial waste water of 570,000 cu m/day. Treatment facilities will include a pumping well, pre-aeration tank, primary settling tank, final settling tank, storm water settling tank, chlorination, sludge treatment, and sludge thickening. Pump well water level, aeration, return sludge system volume, excess sludge volume, and power supplies will be controlled from a central supervisory control panel. Nine industrial television cameras will be used to observe various activities in the plant. Diagrams of apparatus layout in the control room, computer hardware system, supervisory control system, sewage treatment plant flow, and the control system for return sludge are provided. Vertical water flow meters and level meters will trigger changes in power intake and distribution, operation of the main facilities, treatment mode, and chlorine dosage. The computerized control system is designed for expansion to accomodate any future plant expansions. (Schulz-FIRL)
W78-02323

PUMP APPLICATIONS IN SEWAGE SLUDGE DEWATERING PROCESSES,
D. J. Lambert.
Water and Waste Treatment, Vol. 20, No. 9, p 43-46, September, 1977. 6 fig.

Descriptors: *Dewatering, *Pumps, *Pumping, *Filtration, *Sludge treatment, Filters, Centrifugation, Incineration, Activated sludge, Sewage treatment, Waste water treatment.

A variety of treatment and disposal options are available for the estimated 1.5 million tons of sludge generated in the United Kingdom annually. Pumps can be used to transport sludges having moisture contents greater than 80%. Various sludge types, including primary, humus, seed or breeder, activated, consolidated, and digested sludges, are discussed with respect to moisture content and permissible pump speeds with helical rotor positive displacement pumps. Current commonly used dewatering processes include sludge drying beds, plate and frame filter presses, continuous or semi-continuous belt presses, roto-plug concentrators, vacuum filters, centrifuges, and incinerators. In sludge drying beds, positive displacement helical rotor/stator pumps are used where head exceeds 20 m and centrifugal pumps where head is less than 20 m. The use of helical rotor positive displacement pumps is discussed with respect to controlling the flow rate to a filter press, incinerator, vacuum filter, and centrifuge. A helical rotor pump speed selection chart is presented for selection of pump speed with respect to sludge moisture content and pump port size. (Schulz-FIRL)
W78-02350

HOSPITAL'S WASTE.
Water and Waste Treatment, Vol. 20, No. 9, p 54, 56, September, 1977.

Descriptors: *Pumps, *Pumping, *Sewage treatment, Equipment, *Valves, Sewerage, Municipal wastes, Waste water treatment.

The Tuke and Bell gravity-filled ejector system, the Electromatic Sewage Ejector, has replaced centrifugal pumps previously used for sewage transport at a hospital under the jurisdiction of the East Anglian Water Authority in England. The problematic hospital sewage, which frequently clogged suction pipework, pump casings, and delivery valve systems, had created problems with operation and maintenance of the centrifugal pump system. To accomodate the required design capacity of 150 gpm, special ejector bodies were designed and 22-KW compressors were used to provide directly to the main sewer, the inlet chamber was equipped with a roller screen on skids operated by an electric motor. Rotary valve or electrode control units were not required with the Electromatic ejector. Operations were controlled by the displacement of a small amount of air through nylon transfer tubes by influent to control opening and closing of the solenoid. (Schulz-FIRL)
W78-02354

OPTIMAL CONTROL OF SEWAGE AND RAIN PUMPS BASED ON INFLUENT FLOW PREDICTION,
Tokyo Sewerage Bureau (Japan).
S. Kato, M. Shioya, A. Shiraishi, M. Kashiwagi, and M. Ozaki.
Hitachi Review, Vol 26, No 7, p 235-240, 1977. 6 fig, 2 tab, 6 ref.

Descriptors: *Mathematical models, *Computer models, *Combined sewers, *Storm water, *Pumping, Model studies, Urban runoff, Monitoring, Estimating, Flow control, Flow rates, Waste water treatment.

Pumping stations servicing combined sewer lines are subjected to varying influent flow rates during wet and dry weather conditions and in situations where a diurnal distribution in sewage flow occurs. When flow rates of influent to the pumping station can be predicted, pump start-up and operation can be controlled to raise treatment efficiency, minimize energy consumption, and prevent combined sewer overflows. The mathematical models which are presented include an influent prediction model and a scheduling model for quasi-optimum pump operation. The first model utilizes a multiple regression analysis technique to predict influent flows up to 1 hr in advance on the basis of stored volume in the sewer, calculated from sewer line sizes and suction well water level, pumping rate, and rainfall data. The scheduling model or Quasi-optimum Routing System (QRS) is based on the variation of pumping rate through control of the number of pumps in operation with respect to stored volumes and cumulative curves for pumping rate, sewer line capacity, and influent flow rate over a given time period. The QRS technique utilizes a heuristic algorithm to search for a pump scheduling route which minimizes start-stop frequency. The algorithm can then be used in evaluation functions for the total number of pump switchings, energy consumption, variation of pumping rate, operating time of a specified pump, and energy consumption per pumping rate. (Schulz-FIRL)
W78-02387

HYDRAULIC FRACTURE EXPERIMENTS IN GT-1 AND GT-2,
Los Alamos Scientific Lab., NM.
For primary bibliographic entry see Field 8E.
W78-02540

NEW SOURCES OF ENERGY: PROCEEDINGS OF THE CONFERENCE, VOLS. 2 AND 3, GEOTHERMAL ENERGY.
United Nations, New York.
For primary bibliographic entry see Field 4B.
W78-02541

DESIGN OF A WATER JET DRILL FOR DEVELOPMENT OF GEOTHERMAL RESOURCES: PROGRESS REPORT, JUNE 1, 1975 - JUNE 1, 1976,
Missouri Univ.-Rolla. Rock Mechanics and Explosives Center.
D. A. Summers, and D. J. Bushnell.
Report No. COO-2677-2, June, 1976. 38 p, 19 fig, 5 tab, 5 ref.

Descriptors: *Rotary drilling, *Nozzles, Jets, Orifices, Drilling fluids, Equipment, Laboratory tests, Drill holes, Pressure, Sandstones, Geothermal studies, Polymers, Penetration rate, Confining pressure.

A nozzle design developed under ERDA contract has drilled relatively soft sandstone at rates of up to 280 in./min. This dual orifice nozzle has an orifice diameter ratio of 2:1, with the smaller orifice directed forward while the larger orifice was angled outward at 30 degrees. It was judged to give superior performance. Tests were performed using a modified Soiltest No. T-8154 chamber as a pres-

sure vessel to simulate downhole conditions at around 6,000 feet. Various rations of bit feed rate vs. rotational speed were tested. High rotational speeds were found to produce the smoothest hole walls and thus the easiest nozzle passage. Four polymer drilling fluid additives were also tested with the system, and all four were effective in improving penetration rate when compared with plain water. Further tests in different rocks and with different nozzle configurations (including cavitation nozzles) were planned at the time of this report. (Eberle-NWWA)
W78-02543

LABORATORY TESTS OF RELIEF WELL FILTERS: REPORT 1, WELLS ALONG THE MISSISSIPPI RIVER LEVEES, ALTON TO GALE, ILLINOIS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 8B.
W78-02545

CONCEPTUAL DESIGN OF COMMERCIAL 50 MWE (NET) GEOTHERMAL POWER PLANTS AT HEBER AND NILAND, CALIFORNIA.
Bechtel International Corp., San Francisco, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as SAN-1124-1, Price codes: A15 in paper copy, A01 in microfiche. ERDA Publication No. SAN-1124-1, October, 1976. 308 p, 63 fig, 20 tab, 76 ref.

Descriptors: *Geothermal studies, *Thermal powerplants, Thermal power, Flash distillation, Brines, Design, Sites, Capital costs, Construction costs, Energy, Instrumentation, Electric power, Electrical equipment, Turbines, Generators, Environmental impact, Cooling, Materials, Heat transfer, *Salton Sea Geothermal Field(Calif), Binary Cycle systems.

The scope of this study includes conceptual designs, corresponding capital cost estimates and engineering and construction schedules for two 50 MWe (NET) commercial-scale geothermal plants. In order to develop and illustrate the concepts involved, the reservoir and site conditions of the geothermal field near Heber, California, which has moderate-temperature low-salinity brine, were used for one of the plants. Field conditions near Niland, California (or the Salton Sea Geothermal Field), representing high-temperature high-salinity brine, were used for the other power plant. Together the two plants provide engineering perspective for the range of hydrothermal resources that are of economic interest for electric power generation. The direct-flash energy conversion process was evaluated for the Heber power plant. The Niland plant design employs a multistage-flash/binary process that was adapted from desalination technology, with isopentane used as a working fluid. (Eberle-NWWA)
W78-02550

PROVINCIAL DRILLING METHODS IN BANGLADESH: PART II,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 4B.
W78-02554

8D. Soil Mechanics

THERMAL REGIME OF AN EARTH DAM BUILT ON A PERMAFROST BASE DURING CONSTRUCTION AND INITIAL OPERATION,
Gorkovskii Inzhenerno-Stroitelnyi Inst. (USSR).
V. N. Grandilevskiy, Ye. S. Gogolev, V. P. Kulikov, and A. V. Fevralev.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-026 678, Price codes: A02 in paper copy, A01 in microfiche. Cold Regions Research and Engineering Laboratory Draft Translation 527, May 1976. 6 p, 1 fig, 2 tab, 2 ref. Translated from Stroitel'stvo i arkhitektura, No. 8, 1975.

Descriptors: *Dam construction, *Earth dams, *Permafrost, *Arctic, Cold weather construction, Temperature, Cold regions, Structures, Hydraulic structures, Construction, Dams, Foreign research, Thermal properties, Infiltration, Seepage, Dam foundations, *USSR.

The conditions of the construction of an earth-filled dam on a permafrost foundation have a substantial influence on the thermal mode of the dam during the initial operating period. Construction conditions include the methods and time of construction of a dam; thermophysical characteristics of the soils from which the dam is made; thickness of the layers of soil with which the dam is filled during the summer and autumn seasons and duration of that period; climatic conditions and duration of the winter-spring period, during which dam building operations are postponed. (Sims-ISWS)
W78-02237

BEACH, HIGHWAY AND SEWER PLAN ROLLED INTO ONE.
Engineering News-Record, Vol. 199, No. 14, p 44, October, 1977. 1 fig.

Descriptors: *Multi-purpose projects, *Parks, *Sewers, *Sands, *Recreation facilities, Highways, Road construction, Conveyance structures, Erosion, Design data.

The $17-19.5 million Great Highway-Ocean Beach project was initiated as a multi-purpose project, since construction of a large consolidation sewer line was expected to remove or damage most of the existing upper Great Highway in San Francisco. The program included reconstruction and redesign of the highway for a distance of 3.6 miles, restoration of sand dunes, and creation of a linear park, along with construction of the sewer line. The plan was designed by Michael Painter and Associates of Sausalito, and Tudor Engineering Company and Chin and Hensolt of San Francisco, California. The plan recommended lowering the profile of both the highway and beach, extending the beach 200 ft west to add 48 acres of recreational area. The dunes would be revegetated and beach access would be improved. A curving four-lane highway with bicycle paths would replace the existing stretch of highway, which had been partially blocked by encroaching sand dunes. (Schulz-FIRL)
W78-02311

EFFECTS OF SPECIMEN RECONSTITUTION ON CYCLIC TRIAXIAL RESULTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Soils and Pavements Lab.
W. F. Marcuson, III, and F. C. Townsend.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-024 917, Price codes: A03 in paper copy, A01 in microfiche. Miscellaneous Paper S-76-5, April 1976. 28 p, 12 fig, 1 tab, 3 ref.

Descriptors: *Soil tests, *Soil stability, *Dam construction, Earth materials, Construction materials, Strength of materials, Soils, Laboratory tests, Soil strength, Soil mechanics, Soil physics, Soil properties, Dams, Earth dams, *Fort Peck Dam, Specimen reconstitution, Liquefaction(Soils).

The Army Engineer Waterways Experiment Station (WES), in connection with a dynamic analysis of Fort Peck Dam, conducted a series of dynamic laboratory tests on reconstituted specimens of Fort Peck materials to evaluate their liquefaction potential. From a comparison of the laboratory results with other laboratory results obtained for undisturbed hydraulic-fill material, it was apparent that reconstitution did affect the results. To evaluate more fully this effect, various laboratories and institutions engaged in dynamic testing were contacted in an effort to determine the state of the art in this area. After reviewing the present state of the art, WES conducted cyclic triaxial compression tests on undisturbed specimens from Fort Peck Dam. The specimens then were reconstituted to the as-tested density, and the cyclic triaxial tests were repeated. The test results indicated that the undisturbed specimens were repeated. The test results indicated that the undisturbed specimens were approximately 70 to 80% more stable than the reconstituted specimens. (Sims-ISWS)
W78-02610

8E. Rock Mechanics and Geology

HYDRAULIC FRACTURE EXPERIMENTS IN GT-1 AND GT-2,
Los Alamos Scientific Lab., NM.
R. L. Aamodt.
Available from the National Technical Information Service, Springfield, VA 22161 as LA-6712, Price codes: A02 in paper copy, A01 in microfiche. Publication No. LA-6712, February, 1977. 19 p, 32 fig, 2 tab, 10 ref.

Descriptors: *Geothermal studies, *Heat flow, Temperature, Fractures, Cracks, Permeability, *Structural geology, Water circulation, Hydrostatic pressure, Thermal properties, Heat transfer, Crystalline rocks, Granites, *Hydraulic fracturing, Apparent surface energy, Fluid recovery, Earth stress, Propping, Los Alamos(New Mexico).

Fluid circulated in artificial cracks in regions where shallow rocks have abnormally high heat-flows can be used to extract heat energy. Hydraulic fracturing experiments were conducted in granites at temperatures near 100 degrees and 150 degrees C, in two wells near Los Alamos, N.M. The wells were 0.785 km (2575 ft.) and 1.98 km (6500 ft.). No unusual difficulty was observed in fracturing crystalline rock hydraulically. The energy required to create the new fracture surface by breaking the rock (apparent surface energy) was measured as 100 J/miles square. In the second well, the orientation of the fracture was measured as roughly 35 degrees E. The fraction of the fluid injected into the second fracture that could be recovered at hydrostatic surface pressure was measured. The efficiency of this recovery was as high as 92 percent after the impedance to flow was lowered within the fracture by 'propping' the fracture with sand. The permeability of the rock over the face of the fracture was compatible with laboratory measurements between 10 to the (-7) and 10 to the (-8) darcys. Downhole pressures required to extend the fractures were about 150 and 340 bars (2175 and 4900 psi), respectively. Interactions of old and new fractures were also studied. (Palmer-NWWA)
W78-02540

DESIGN OF A WATER JET DRILL FOR DEVELOPMENT OF GEOTHERMAL RESOURCES: PROGRESS REPORT, JUNE 1, 1975 - JUNE 1, 1976,
Missouri Univ.-Rolla. Rock Mechanics and Explosives Center.
For primary bibliographic entry see Field 8C.
W78-02543

NEW TECHNOLOGY OF DRILLING WELLS IN PERMAFROST: CHAPTER 6, DRILLING WITH SIMULTANEOUS FREEZING OF WET, LOOSE ROCKS,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 8B.
W78-02544

8F. Concrete

ALTERNATE MATERIALS OF CONSTRUCTION FOR GEOTHERMAL APPLICATIONS,
Brookhaven National Lab., Upton, NY. Dept. of Applied Science.
For primary bibliographic entry see Field 8G.
W78-02290

BENEFITS FROM GROUTING AN ENTIRE SEWER SYSTEM,
Lower Allen Township Authority, Camp Hill, PA.
V. C. Wass, and C. M. Bush.
Public Works, Vol 108, No 11, p 55-57, November, 1977. 1 tab.

Descriptors: *Sewers, *Infiltration, *Inflow, *Chemical grouting, Flow control, *Grouting, Construction materials, Joints(Construction), Conveyance structures, Sewerage, Waste water treatment, Camp Hill(PA).

An extensive 2-yr program for sewer renovation in Camp Hill, Pennsylvania, was conducted in response to waste water flow measurements which indicated that actual flow was 3.2-6.0 mgd when it should have been in the range 1.6-2.0 mgd based on the population size serviced by the sewer system. Video Pipe Grouting, Inc., was contracted by the Lower Allen Township Authority for the project, which included cleaning and chemical grouting with closed circuit television inspection of the area's 76 miles of sewer lines. An initial inspection by Video Pipe revealed roots from fast-growing pin oak, maple, and sycamore trees in the 20-yr-old system and associated infiltration/inflow. Rehabilitation of the system included removal of root growths, sealing of leaking joints with grout which contained a root inhibitor, cleaning of all lines, and cementing of manhole walls where infiltration was particularly heavy. Average flow was reduced by the rehabilitation program to 1.5 mgd, resulting in lower waste water treatment costs for chemicals, electrical power, general operating costs, and collection system repairs. (Schulz-FIRL)
W78-02309

R7-M JOHANNESBURG SEWER TUNNEL.
The Civil Engineer in South Africa, Vol. 19, No. 7, p 163, July, 1977.

Descriptors: *Sewerage, *Conveyance structures, *Pipelines, *Engineering geology, Construction, Municipal wastes, Waste water treatment.

The 7-km long Bushkoppie outfall sewer is being built as part of a sewer construction program being conducted by the city of Johannesburg in South Africa. During the second phase of the program a second, 9-km long sewer tunnel will be constructed to join the Bushkoppie sewer at about 3.5 km from the proposed Bushkoppie sewage treatment plant slated for operation by 1981. The upstream portion of the tunnel will have a D-shaped cross-section and will be 2 x 2 m. The section below the confluences will be enlarged to a height of 2.5 m and a width of 2.75 m. The tunnel, which runs through residual lava of the Vertersdorp system with a depth below ground level of 5-60 m, will be lined with 300 m of dolomitic concrete. Steel arches at 1-m spacing with wire mesh and shotcrete are being used to reinforce the tunnel in unstable sections. The use of dolomitic aggregates and a 75-mm concrete cover are expected to alleviate the effects of corrosion in the tunnel, which will only have two vent shafts and a maximum slope of 1:1200. LTA Construction and Bomat Civil Engineering were contracted for construction and tunnelling in the 7-million-rand project. (Schulz-FIRL)
W78-02313

PLASTIC LINED CONCRETE CHANNEL FOR WASTE WATER PURIFICN. PLANT - ASSEMBLED FROM PREFABRICATED MODULAR ELEMENTS WITH SEALED PLASTIC JOINTS.
Belgian Patent BE 852-803. Issued September 23, 1977. Derwent Belgian Patents Abstracts, Vol. Y, No. 39, p 2, November, 1977.

Descriptors: *Oxidation, Equipment, *Patents, *Concrete pipes, Construction materials, Design data, Waste water treatment, Plastics.

A plastic lined channel has been patented for use in oxidation during waste water treatment. The elongated channel is constructed of a series of tubular parallel-piped elements, each of which is equipped with inlet and outlet openings of the same size and lined with a sheet of thermoplastic material which extends through the openings to form flaps. During assembly of two elements for continuous flow, the outlet of one element and the inlet of the other element are superimposed and the corresponding flaps and lining of thermoplastic material are seam-welded together. A manhole aperture can be placed at the top of an element which has two open ends for straight-through flow. In this instance, the thermoplastic sheeting is secured during casting of the concrete by protruding studs on one side of the sheeting. The prefabricated modular elements are designed to allow rapid construction of channel oxidation zones of any size and shape in waste water treatment plants. (Schulz-FIRL)
W78-02315

CONCRETE FORMING FOR WATER AND WASTE TREATMENT PLANTS.
Concrete Construction, Vol. 22, No. 11, p 615-617, November, 1977.

Descriptors: *Construction materials, *Concrete construction, *Concrete technology, *Cast-in-place structures, *Engineering structures, Concrete plants, Conveyance structures, Framework(Construction), Water treatment, Treatment facilities, Waste water treatment.

Concrete has been used as a construction material for a wide variety of water, sewage, and industrial waste treatment projects. Construction requirements may vary greatly from one project to the next, but site-cast concrete can be designed and built to provide desired hydraulic characteristics, to produce a watertight system, and to accomodate almost any other design requirement. Reusable factory-built modular forms are discussed as an alternative to custom-built forms which can rarely be reused. Modular forms which are currently manufactured are usually in the form of panels on a steelframe backing faced with plastic-coated plywood to insure smooth surfaces after multiple reuse. The panels can be connected to produce straight or curved walls, Y-walls, haunches, and slabs. Experiences with the use of modular forms during construction at the Meander Water Pollution Control Project in Mineral Ridge, Ohio, are described. (Schulz-FIRL)
W78-02395

8G. Materials

FREQUENCY-RESPONSE ANALYSIS OF AUTOMATED CANALS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 8C.
W78-02271

BUREAU OF RECLAMATION, CONSTRUCTION WORKER SURVEY,
Arizona State Univ., Tempe. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W78-02275

GEOTHERMAL ENERGY RECOVERY PROCESS,
Bechtel Corp., San Francisco, CA.
For primary bibliographic entry see Field 3A.
W78-02277

PROVINCIAL DRILLING METHODS IN BANGLADESH: PART I,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 8B.
W78-02286

SCANNER, ORIENTER HELP FIND CASING LEAKS,
E. S. Pennebaker, and R. T. Woody.
Oil and Gas Journal, Vol. 75, No. 49, p 75-80, November 28, 1977. 10 fig, 5 ref.

Descriptors: *Electrical well logging, Subsurface investigations, Wells, Well casings, Subsurface waters, Sands, Grouting, *Sonic logs, *Temperature logs, *Behind-casing leaks, Squeeze cementing, Noise logs, High pressure sands.

The temperature-noise log is useful in the location of behind-casing leaks. Temperature and sound profiles reinforce each other and enhance interpretation of channels where fluid movement occurs in cemented areas behind metal well casing. A log format which uses condensed and expanded depth scale presentations of both temperature and sound data is used to detect well problems producing subtle changes in sound and temperature. The technique consists of logging temperature from surface to total depth on the trip in the hole. Then with the same tool, sound intensity readings are obtained at selected levels on the way out. The logging sound which performs this task is a combination piezoelectric-crystal sound detector and temperature probe with collar locator and downhole amplifiers, all in one tool. Data can be recorded only when the tool and line are stationary and all well head valves, compressors and waterflood pumps are shut down to eliminate all extraneous noise. The surface panel is a portable, self contained unit for use with any single-conductor-line recording unit. When a positive voltage is applied to the tool, temperature data return, when a negative voltage is sent down the line the sound amplifiers are activated and the resulting sound intensities for various frequency cuts are recorded and displayed on digital meters in decibels. (Heiss-NWWA)
W78-02287

GEOTHERMAL MATERIALS STUDIES: METALLURGY DIVISION QUARTERLY REPORT, APRIL-JUNE 1976,
California Univ., Livermore. Lawrence Livermore Lab.
A. Goldberg.
Available from the National Technical Information Service, Springfield, VA 22161 as UCID-17261-76-2, Price codes: A03 in paper copy, A01 in microfiche. Report No. UCID-17261-76-2, June, 1976. p 26, 4 fig, 9 tab.

Descriptors: *Thermal power, Equipment, *Erosion, *Corrosion, *Turbines, *Nozzles, Brines, Metallurgy, Salinity, Acidity, Titanium, Laboratory tests, *Geothermal studies, *Total flow process, Chemical coatings.

Since its inception in 1974, the Lawrence Livermore Laboratory Geothermal Program has evolved into two basic activities: (1) providing advanced technologies for hydrothermal systems with emphasis on the Total Flow Process (2) maintaining an Industrial Support Program to provide technical assistance to joint ERDA/industry projects. In the Total Flow Process, the total flow of the wellhead is expanded through converging-diverging nozzles to convert the enthalpy of the

fluid into kinetic energy to drive impulse turbines. This process is expected to be as much as 60% more efficient than either flashed steam or binary cycle power generation. Among the studies being done at the laboratory are nozzle-and-turbine erosion tests to investigate the durability of various chemical coatings, hard facings, and inserts under conditions simulating the severe environment of high-velocity brine and entrained particulates. General corrosion and stress corrosion experiment and evaluations are also being run on various components of a Total Flow turbine generating system. (Eberle-NWWA)
W78-02289

ALTERNATE MATERIALS OF CONSTRUCTION FOR GEOTHERMAL APPLICATIONS,
Brookhaven National Lab., Upton, NY. Dept. of Applied Science.
L. E. Kukacka, J. Fontana, W. Horn, J. Amaro, and T. Sugama.
Available from the National Technical Information Service, Springfield, VA 22161 as BNL-50627, Price codes:A03 in paper copy, A01 in microfiche. Progress Report No. 11, BNL 50627, April, 1977. 31 p, 6 fig, 17 ref.

Descriptors: *Thermal power, *Wells, *Brines, *Concrete mixes, *Polymers, Geothermal studies, Concrete pipes, Salinity, Acidity, Laboratory tests, On-site investigations, Concrete additives, Portland cements, The Geysers(Calif), Klamath Falls(Ore).

The feasibility of using concrete-polymer composites as materials in construction for handling hot brine was demonstrated in 1972 in work sponsored by the Atomic Energy Commission and the Office of Saline Water. A research program to determine if the composites were applicable to geothermal systems was initiated in April 1974; both laboratory and field tests have since been performed. Significant improvements in the thermal stability of polymer cement lining materials have been made by the use of various chemical additives and by increasing the amount of portland cement in the aggregate. An optimum aggregate composition of 50% sand to 50% cement has been determined. Laboratory tests of specimens under various temperatures, brine compositions, and acidity conditions have yielded encouraging results, as have initial field tests at Baca Wells, The Geysers, Klamath Falls, and Raft River. A second field test series has been initiated. Work accomplished during the period October 1 - December 31, 1976 is described in this report. (Eberle-NWWA)
W78-02290

SEWERAGE OUTFALL PROTECTED.
Corrosion Prevention and Control, Vol 24, No 4, p 30, August, 1977.

Descriptors: *Sewerage, *Pipes, *Outfalls, *Corrosion, *Construction materials, Sewage treatment, Sewers, Waste water disposal, Treatment facilities, Waste water treatment, Diffusers.

A sea outfall constructed in 1973 for the Southern Water Authority in England includes a diffuser system with 50 outlets at the sea floor and a terminal outlet. Winn and Coales (Denso) Ltd. supplied an anti-corrosion system to protect joints in the diffuser outlets, diffuser pipes, the main sluice valve, and bolted pipe couplings. A 42 inch steel pipe 3,350 m long will lead from the Mewbrook Treatment Works near Rustington to the diffuser system. (Schulz-FIRL)
W78-02303

AN OLD BRICK SEWER FINDS A SILVER LINING,
R. West.
Surveyor, Vol 150, No 4448, p 8-10, September, 1977.

Descriptors: *Combined sewers, *Construction materials, *Linings, *Epoxy resins, *Sewerage, Protective coatings, Pumps, Repairing, Pipes, Conveyance structures, Waste water treatment, Sewage treatment, Sewer linings.

A television monitoring program of the sewer system in the town of Kidderminster in England revealed the deteriorated condition of a 900 x 675-mm brick combined sewer. Conventional sewer repair processes were hindered by the fact that 65% of the sewer ran underneath the area's carpet factories. Edmund Nuttall's Instituform technique in which a tube of terylene needle felt, covered with polyethylene and impregnated with polyester resin, is used to line an existing sewer was chosen. The 12-mm thick tube is transported to the site and emplaced while still in a liquid state so that irregularities in the sewer contour did not pose severe problems in the lining process. Cement grouting was forced under pressure through holes drilled in the cured lining to backfill any cavities. Two 200-mm and one 150-mm Univac pumps were used to eliminate any danger from storm water flow during the lining processes. A 'flow-through' inflation bag was placed inside the lining tube to accomodate any surplus flow. The sewer was cleaned before emplacement of the lining and the lining material was transported to the site by refrigerated truck in 35-ft lengths. The lining is inflated with a low-pressure air blower and cured with a steam-air mixture at 70C. (Schulz-FIRL)
W78-02305

DEVELOPMENT AND LAYING OF PIPES.
Water Services, Vol 81, No 978, p 473-474, August, 1977. 1 ref.

Descriptors: *Construction materials, *Pipelines, *Pipes, *Plastic pipes, *Sewerage, Linings, Joints(Construction), On-site data collections, Costs, Metal pipes, Waste water treatment.

Various aspects of pipeline technology and pipeline design are discussed. Future developments in the use of flexible-type conduits are expected with increased interest in the use of glass fiber reinforced plastics, the use of pipe materials with thinner walls, and the use of larger-diameter bulk transmission mains. The use of a wide variety of pipe materials also requires the development of appropriate pipeline installation practices. Site evaluations are suggested to insure the most cost-effective method of installation. The development of equipment for backfilling and excavation and of other products such as self-anchoring joints is suggested to speed up installation and thereby significantly reduce total costs. Specialized construction materials or pipe linings to repair existing mains and to protect pipelines from corrosive soils, effluents, and soluble sulfates may reduce future maintenance and construction costs. (Schulz-FIRL)
W78-02306

SEWER REHABILITATION CUTS INFILTRATION,
E. C. C. Li.
Water and Sewage Works, Vol 124, No 11, p 86-87, November, 1977. 2 fig, 1 tab.

Descriptors: *Sewerage, *Pipes, *Infiltration, *Inflow, Analytical techniques, *Sewers, Manholes, Rehabilitation, Concrete pipes, Flow control, Joints(Connections), Municipal wastes, Waste water treatment, Sam Rayburn(TX).

An infiltration/inflow study was conducted by East Texas Engineering and Construction Company for Rayburn Country, a development in East Texas with 21 subdivisions and 204,294 ft of sewer line. Exfiltration and smoke tests indicated that much of the infiltration/inflow came from 40,470 ft of sewer lines and 195 manholes in 5 of the 21 subdivisions. The system, constructed in 1966 of concrete pipe with rubber gaskets, was checked by a three-man testing crew and three workers with a backhoe loader tractor. An air-loc ball was used to plug a water-filled section of sewer and the amount of water loss over a given time was used as a measure of exfiltration rate. Smoke tests with a portable 1,500-cfm blower and smoke bombs were used where exfiltration testing was difficult. Causes of the 217 sources of extraneous flow found in the testing program included: leaks in precast concrete manholes; inflow through low or perforated manhole covers: leakage through cracked, offset or open joints; deterioration of the concrete encasements which connected cast iron and concrete pipes; root intrusion; faulty house laterals; and pipe breakage, joint offsets, and cracked cells caused by reverse grade and improper bedding and backfilling. Shear pipe breaks were more commonly observed than beam breaks and no longitudinal breaks were found. The rehabilitation project has repaired 126 line leaks and 91 manhole perforations so far, as well as replacing 1,204 ft of sewer line, to reduce infiltration by 60%. (Schulz-FIRL)
W78-02307

I/I STUDY TURNS TO T. V.,
Larkin and Associates, Kansas City, MO.
R. Lamberton.
Water and Wastes Engineering, Vol 14, No 10, p 30-32, October, 1977.

Descriptors: *Sewerage, *Monitoring, *Infiltration, *Sewers, *Analytical techniques, Flow measurement, Inflow, On-site data collections, Municipal wastes, Conveyance structures, Waste water treatment, Warrensburg(MO).

A sewer infiltration/inflow study was conducted by Ace Pipe Cleaning, Inc., and Larkin and Associates of Kansas City, Missouri, for the city of Warrensburg at an estimated cost of $45,000. The study was required by the EPA and state agencies in Missouri as part of a proposed sewer system renovation project. A complete inventory and mapping of the sewer system was carried out to identify manholes subject to inflow because of top elevation, location, and condition. Smoke testing located point sources of direct entrance of storm water inflow and all sewer lines were cleaned and inspected by television. The program located 60 defective manholes and 160 inflow points which were designated for correction. (Schulz-FIRL)
W78-02308

BENEFITS FROM GROUTING AN ENTIRE SEWER SYSTEM,
Lower Allen Township Authority, Camp Hill, PA.
For primary bibliographic entry see Field 8F.
W78-02309

DESIGN OF A WATER JET DRILL FOR DEVELOPMENT OF GEOTHERMAL RESOURCES: PROGRESS REPORT, JUNE 1, 1975 - JUNE 1, 1976,
Missouri Univ.-Rolla. Rock Mechanics and Explosives Center.
For primary bibliographic entry see Field 8C.
W78-02543

8I. Fisheries Engineering

OBSERVATIONS ON THE STATUS OF THE DEVIL'S HOLE PUPFISH IN THE HOOVER DAM REFUGIUM,
Nevada Univ., Las Vegas. Dept. of Biological Sciences.
J. E. Williams.
Bureau of Reclamation, Engineering and Research Center, Denver, Colorado, Report No REC-ERC-77-11, September 1977. 15 p, 8 fig, 2 tab, 7 ref.

Descriptors: *Refugium, Transplanted population, Establishment, *Pupfish, Sex ratio, Population

fluctuations, Morphometrics, Meristics, Desert fish, *Endangered species, Aquatic ecology, Hoover Dam refugium, Devil's Hole, Cyprinodon diabolis.

In October 1972, a multiagency effort at establishing a second population of the endangered Devil's Hole pupfish, Cyprinodon diabolis, was initiated with the transplanting of 27 fish into a refugium below Hoover Dam, Clark County, Nev. From October 1975 through March 1977, the first concentrated effort at examining the dynamics of this transplanted population was undertaken. About four or more generations of pupfish have now been produced in the refugium, establishing it as the species' second population. Population fluctuations correspond well with those observed in the fishes original habitat, with the highest numbers occurring in late summer and early fall and the lowest levels in late winter. Morphometric measurements showed an increase in standard length of the fish in the transplanted population, as well as significant differences in four of six other measurements taken. Meristic data, appearing less susceptible to change, showed insignificant variation between the transplanted population and the one in Devil's Hole. The Hoover Dam refugium, while an adequate environment for survival, and even reproduction, of Cyprinodon diabolis, fails to provide conditions equal to those existing in the fishes natural habitat, Devil's Hole. The presence of predatory dragonfly larvae may become an important factor in the refugium. (Bur Reclam)
W78-02268

THE LAKE TROUT OF TWIN LAKES, COLORADO,
Colorado Cooperative Fishery Unit, Fort Collins.
J. R. Griest.
Bureau of Reclamation, Engineering and Research Center, Denver, Colorado, Report No REC-ERC-77-4, March 1977. 29 p, 8 fig, 11 tab, 42 ref.

Descriptors: *Lake trout, Fish management, Ecology, Aquatic habitats, Pumped storage, *Environmental effects, Powerplants, Environments, Fish populations, *Limnology, Colorado, *Twin Lakes(Colo), Fryingpan-Arkansas Proj(Colo).

Growth, survival, reproduction, recruitment, and food habits of lake trout in Twin Lakes, Colo., were examined during 1974-1975 to document the status of the trout population prior to completion of a 200-megawatt pumped-storage hydroelectric powerplant being constructed on the lake. The powerplant will become operational during 1977, and data collected during this study will be compared to similar data collected during the post-construction period to determine the effect of plant operation on the trout population. Growth of lake trout in Twin Lakes is comparable to that of other lake trout fisheries in the Western United States, such as Lake Tahoe, Nev.-Calif., and Fish Lake, Utah, and is somewhat faster than most lakes located in Canada. Annual mortality was near 50 percent, which compares with other lake trout fisheries of this type. Successful reproduction of lake trout was confirmed by the presence of age classes that had not been stocked. Approximately 90 percent of 4-year-old fish captured during the study were from natural reproduction. Lake trout reaching the legal size limit of 381 mm were usually 4-year-olds, with approximately 20 percent of the population reaching this size each year. Lake trout in Twin Lakes feed primarily on Mysis relicta. Chironomid larvae, white suckers, and rainbow trout are also eaten. Possible effects of powerplant operation on the lake trout population are outlined and discussed. (Bur Reclam)
W78-02269

ECOLOGY OF MYSIS RELICTA IN TWIN LAKES, COLORADO,
Colorado Cooperative Fishery Unit, Fort Collins.
R. E. Gregg.
Bureau of Reclamation, Engineering and Research Center, Denver, Colorado, Report No REC-ERC-76-14, December 1976. 70 p, 34 fig, 18 tab, 64 ref.

Descriptors: *Limnology, Aquatic animals, Lakes, Reservoirs, Powerplants, *Pumped storage, *Environmental effects, Migration, Ecology, Aquatic environment, Benthos, Fish food organisms, Zooplankton, Colorado, *Lake trout, Oligotrophy, Turbulence, Turbidity, Fryingpan-Arkansas Project(Colo), Mt Elbert Pumped-Storage Powerplant(Colo), *Twin Lakes(Colo).

The Mt. Elbert Pumped-Storage Powerplant at Twin Lakes, Colo., is a major feature of the Bureau of Reclamation's Fryingpan-Arkansas Project. Twin Lakes are oligotrophic lakes of glacial origin located in the montane zone of the Rocky Mountains. The lake trout fishery at Twin Lakes is one of the best in Colorado. The major source of food for the lake trout in recent years has been Mysis relicta Loven, introduced to Twin Lakes in 1957. Vertical migrations of this freshwater mysid were studied using three ring nets and a benthic sled towed simultaneously on a single cable. Migrations vary in timing and magnitude and juveniles migrate more extensively than adults. Horizontal distribution and movements were determined from trawls taken at 17 stations monthly for 2 years. The frequency distribution of Mysis per square metre was fitted to the negative binomial frequency distribution, indicating a highly clumped distribution for benthic Mysis. Deep and shallow water sample comparisons showed Mysis prefer deeper, colder water in the summer, migrating into shallow water in the fall. Studies of the effects on Mysis mortality of turbulence and turbidity created by plant operation revealed that 8 hours of turbulence daily greatly increased mortalities due to exhaustion and mechanical abrasion. Whether such attrition will adversely affect the population is not known. (Bur Reclam)
W78-02270

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

WISCONSIN, A SUMMARY OF ACTIVITIES AND PLANS OF THE UNITED STATES DEPARTMENT OF THE INTERIOR, GEOLOGICAL SURVEY, 1977,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 07C.
W78-02415

CONCENTRATION FACTORS AND TRANSPORT MODELS FOR RADIONUCLIDES IN AQUATIC ENVIRONMENTS. A LITERATURE REPORT,
Environmental Monitoring and Support Lab., Las Vegas, NV.
For primary bibliographic entry see Field 05C.
W78-02452

GEOTHERMAL RESOURCES, EXPLORATION AND EXPLOITATION: A BIBLIOGRAPHY.
Department of Energy, Oak Ridge, TN. Technical Information Center.
For primary bibliographic entry see Field 08B.
W78-02553

ENVIRONMENTAL CONTAMINATION FROM TRACE ELEMENTS IN COAL PREPARATION WASTES. A LITERATURE REVIEW AND ASSESSMENT,
Los Alamos Scientific Lab., NM.
For primary bibliographic entry see Field 05B.
W78-02655

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ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE		
Cornell University, Policy Models for Water Resources Systems	W78-02438--02445 02447--02450 02452--02453	14
Franklin Institute (FIRL), Municipal and Industrial Wastewater Treatment Technology	W78-C2296--02381 02383--02387 02389--02397 02660--02670 02681--02683	114
Illinois State Water Survey, Hydrology	W78-02230--02233 02235--02263 02579--02596 02598--02613 02675, 02684	69
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University of N. Carolina, Metropolitan Water Resources Planning and Management	W78-02623--02624 02627--02644	20
University of Wisconsin, Eutrophication	W78-02215 02217--02218 02220--02221 02264 02454--02456 02458, 02460 02463--02464 02466--02467 02471--02474 02477--02479 02481--02497 02500, 02502 02505--02506 02508--02516 02649--02651 02671 02676--02680	61

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A. CENTERS OF COMPETENCE (CONTINUED)		
University of Wisconsin, Water Resources Economics	W78-02208--02214 02517--02524 02527--02528 02530--02532 02534 02556--02558 02560--02561 02563--02572	36
B. STATE WATER RESOURCES RESEARCH INSTITUTES	W78-02201--02207 02222--02223 02265 02398--02406	19
C. OTHER		
BioSciences Information Service	W78-02216, 02219 02224, 02234 02382, 02388 02425, 02446 02451, 02457 02459 02461--02462 02465 02468--02470 02475--02476 02480 02498--02499 02501 02503--02504 02507 02525--02526 02529, 02533 02555, 02559 02562, 02574 02576--02577 02597 02625--02626 02654, 02658	41
Bureau of Reclamation	W78-02227--02229 02266--02275 02407--02408	15

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c. OTHER (CONTINUED)		
Environmental Information Services, Inc. (Effects of Pollutants on Aquatic Life)	W78-02685--02700	16
Information Planning Associates, Inc.	W78-02614--02622 02652--02653 02655--02657 02659 02672--02674	18
National Oceanic and Atmospheric Administration	W78-02645--02648	4
Office of Water Research and Technology	W78-02225	1
U. S. Geological Survey	W78-02413--02424 02426--02437	24

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